The OTB

THE OLD TIMER'S BULLETIN MAY 2004 VOL. 45 / #2

OFFICIAL JOURNAL OF THE ANTIQUE WIRELESS ASSOCIATION, INC.

Published for the collector, historian and old-time radio operator

Lionel Barrymore plays "Scrooge" in a 1938 Christmas broadcast

AWA CONFERENCE: AUGUST 17-21, 2004

OUR THEME: BROADCASTING

THE OLD TIMER'S BULLETIN

OFFICIAL JOURNAL, ANTIQUE WIRELESS ASSOCIATION, INC.™

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THE PRESIDENT'S MESSAGE

Greetings,

The planning for the Annual conference in Rochester is well underway. As you know the theme for this year is Broadcasting. We will be looking at broadcasting industry from the other side of the microphone this year. The dates for the conference are August 17 - 21, 2004. Plan to be there. Last year there were over 800 attendees at the meet and 250+ vendors in the flea market. This is one of the largest conferences in the country. You do not want to miss it!

The Carolinas Chapter of AWA just had its annual spring meet in Charlotte, NC. It was well attended and the weather was beautiful, Ron Lawrence and crew put on a great show every year. I have been attending this show for many years now and have always thoroughly enjoyed myself and found many treasures. This year was no exception.

The flea market was just about sold out on Friday and there were some excellent pieces of equipment for sale. The seminars this year were well attended, starting off with a tube collecting talk given by Kirk Cline. Next was an in-depth review of the Rider/RCA Chanalyst, followed by a restoration/preservation forum moderated by Paul Farmer. The highlight of the evening was the presentation by Dr. Harold Combs on the latest books on Zenith. We could have spent all evening listening to his presentation. The hours seemed to fly by. If you have time next year in March, make it to this meet. You will not be disappointed.

Well enough for now. I hope to see you at a radio meet in the near future. If you have any questions or comments please contact me, But please no calls after 9:30 p.m. if possible.

Geoffrey Bourne
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LETTERS TO THE EDITOR

All letters to the Editor are read with interest and attention, though not all can be published in this column. Letters may be paraphrased, shortened or otherwise edited to fit the available space. The statements made by our correspondents are their own opinions and do not necessarily reflect the views of either the OTB *staff or the Antique Wireless Association.*

ELECTRIC PICTURES QUARTERLY TO BE PHASED OUT

Peter Yanczer (Marson Woods, MO) sent a copy of the February issue of *Electric Pictures Quarterly* (journal of the Experimental Television society) containing the notice that, sadly, *EHP* will be phased out due to lack of member participation. Peter has enough money left in the treasury to publish two more issues, after which publication will end. Included with this issue was a CD copy of the BBC radio documentary "Seeing by Wireless," which presents the achievements of John Logie Baird. It features the voices of Baird and his son Malcolm as well as those of Ray Herbert and Don McLean.

DE FOREST GOOF

One would find it jarring to find the name E.E. Cummings (with this capitalization) in a poetry magazine and it's equally unsettling to find the name Lee De Forest (sic) in a journal devoted to the history of wireless. There are three examples of this spelling error in the February, 2004 issue of *The OTB* (pages 32 and 45). The correct orthography employs a lower case d. This can be verified in a number of places—most definitively in Lee de Forest's autobiography *Father of Radio*. Not all members of his family employed the small d, and there is an interesting discussion of this fact in a footnote on page 152 of the book *Lee de Forest and the Fatherhood of Radio* by James Hijiya, published by Lehigh University Press.

A. DAVID WUNSCH
Dept. of Electrical & Computer Engineering
University of Massachusetts
Lowell, Mass.

30s NIGHT GETS MIXED REVIEWS

Like many people who participated in the recent "30s Night" AM contest (March 11th and 12th), Jack Wenrich (Avon, NY) writes that he didn't make a lot of contacts (three to be exact), but "had a lot of fun getting there." Jack got on the air using his old OT CW rig (47-46-210), which he had built in 1985. To this he added a 203A class "C" final modulated by a pair of 809s

FROM THE EDITOR

Bonhams Auction, BVWS Garden Party and Harpenden Meet

If you are planning a visit to the UK, schedule it for early June!

First, if you are a serious collector of 19th-century communications hardware, literature, or ephemera, be sure and look at the June 3 "Morse to Marconi" auction notice in our "AWA News" column. To be held in London (UK), the event is being presented by the Bonhams auction house. It looks like a once-in-a-lifetime opportunity to acquire truly significant artifacts that have been closely held in private hands for years. Our limited space doesn't permit doing justice to the event, but you'll find much more information at www.bonhams.com.

The icing on the cake is that two renowned British Vintage Wireless Society events are to follow soon afterwards. These are the Gerald Wells Garden Party for vintage wireless enthusiasts, to be held in West Dulwich, London on June 5th, and the swapmeet at Harpenden to be held the following day. For more information on these, e-mail bvws@hotmail.com

New Schedule Begins This Summer

As mentioned in February's "From the Editor," our new release schedule goes into effect with the next issue. The former August, November, February and May issues will become the July, October, January and April issues. One reason is to provide more timely information about the Annual Conference, which is now being held much earlier so that Conference housing needs don't clash with those of returning Rochester Institute of Technology students. (A certain number of rooms at the R.I.T. Conference Center become either dormitory or guest accommodations depending on R.I.T.'s acade-

(continued on page 6)

driven by a pair of 203s. A D-104 fed a 6J7-76 speech amplifier. Jack has had the modifications for AM in the works for a long time, but when it was announced that 30s night would be AM only, he put the project in high gear and completed it with just one day to spare. He says he "was not ready for the excitement" he felt after all the units were assembled and coaxed into operation. This will probably be Jack's last contest because the Wenrichs will be moving into an apartment about August.

Hank Brown (Lancaster, CA) listened on all contest bands during several different time periods. Although he had all his gear tuned up, checked and ready, he was never able to hear an AWA rig. There was a problem, as reported by other contesters, with various kinds of QRM, including international broadcasters. But Hank is undaunted and will be ready to try again next year. Other participants have shown similar spirit—great!

MORE ON AL SMITH

After reading the article on Al Smith ("Experiences in Early Broadcasting") in the last issue, including your request for reader comments, I did a little snooping around. It turns out that Alvin H. Smith, W0PEX, was an Extra Class licensee who lived between 1958 and 1988 at two addresses in Sioux City, IA. I found no evidence of membership in the Society of Broadcast Engineers, AWA, or the Radio Club of America. However, he did join the IRE in 1951, becoming a Senior Member (a sign of technical drive) in 1962. His IRE listings of the '50s through '70 show him as chief engineer of KTIV (TV) in Sioux City. This is all consistent with his memoir.

LUDWELL SIBLEY
Gold Hill, OR

SW-3 AND RME-69 LORE

Excerpts from a letter sent to Bill Fizette, Editor of "The Communication Receiver" and "A Structured Approach to Fixing Up Those Nice Old Radios."

The February issue of *The OTB* was the greatest ever! Here are a couple of comments on the SW-3 article (page 56).

Regarding tube shields for RF stage, note that the base is identical for the TS and the T58 tube shields. You will find the tube shields for the RF stage vary between sets, but the TS shield was installed in sets that used either a type 24A or a type 35 tube. These were 5-pin tubes and required the larger diameter of the type TS. If the RF tube is a 58 or 6D6, either tube shield could be used, but the T58 is preferred.

I enjoyed Bill Hanlon's article on the RME-69 in "A Structured Approach to Fixing Up Those

(continued on page 6)

FROM THE EDITOR, *continued from page 5*

mic schedule.) The other reason is to provide, more comfortably, proper legal notice of our November board meeting.

If all goes as planned, you are reading this about a week early to maximize the time between issues as we make the changeover.

Father of Amateur SSB Passes On

Let me also call your attention to the piece about Oswald "Mike" Villard, contributed by Ludwell Sibley, in our "Recent Radio, TV and Entertainment Obituaries" column. Villard carried out the on-the-air tests that were instrumental in the acceptance of the Single Sideband mode by the amateur community, and our spectrum hasn't been the same since! Probably no person since Marconi himself has had more on an impact on ham radio practice.

"Mike" Villard
1916-2004

ARCA Antique Radio Gazette Reprint

Yet another item of note in this issue is the article "Two Rich Minds-One Poor Invention," a reprint from Antique Radio Club of America's quarterly newsletter *Antique Radio Gazette*. Those of you who have been members for a while will remember that ARCA merged with AWA back in 1994. By then they had been publishing the *Gazette* for over 20 years. After the merger, the *Gazette* material passed into the archives of the AWA.

At our Conference last year President Geoff Bourne, who had been very active in ARCA, suggested that we try to make some of the old *Gazette* articles available again. This reprint is at least a step in that direction and will become a regular feature of *The OTB*.

Ham Contest Article in Monitoring Times

Besides working on this publication, your Editor also writes the monthly column "Radio Restorations" for *Monitoring Times* Magazine. The May issue of *"MT,"* which should be on the newsstands about the time you receive this issue of *The OTB*, is to have a ham radio focus. So in addition to "Radio Restorations," I've contributed an article about the AWA vintage ham radio operating events. The article opens with a discussion of the state of the amateur radio art at about the close of each the four time periods highlighted in our contests (1929 and earlier; the 1930s; 1946 and earlier; 1960 and earlier). The format of each contest is covered briefly and ham readers are encouraged to join AWA and take part. Do you know a ham who might be seduced into joining and operating? Put a copy in his hands!

LETTERS, *continued from page 5*

Nice Old Radios." In early 1948, I worked on two RME-69s which were taken from a ship that had run onto an uncharted reef in the South Pacific. The ship was used by the Fahnstock Expedition and the RME-69s were off-loaded by the Fahnstock brothers before the ship was abandoned. One of the brothers asked me to restore the sets.

My own RME-69, serial number 2255, has the LS1 noise limiter factory-installed. I have a copy of the original typewritten service manual. Finding the BFO tuning to be too broad (it covered much more than the 8 kHz in the original specs), I removed some of the plates in the tuning capacitor and repeaked the coil. Operation on both CW and SSB was much improved.

PAUL BOHLANDER
North Hills, PA

SILENT KEYS

We record the passing of the following AWA member with deep regret.

DONALD DEAN, 97. (1-04) of Sarasota, Florida was originally from Pontiac Michigan, where he was known as "The Dean of Radio." He repaired radios for 81 years, until 2003.

Note: AWA officers and members are being asked to submit all information about Silent Keys to Joyce Peckham, Box E, Breesport, NY 14816. This will help in the collection and coordination of information and appropriate recognition of both AWA members and others who have made contributions to the electronics and entertainment industries.

AWA NEWS

***OTB* POLICY ON PROMOTING EVENTS:** The *OTB* is pleased to list the meets and meetings of any established antique radio organization, whether or not it is associated with the AWA. Do not send your information directly to the *OTB* Editor. Please send it to Joyce Peckham, Box E, Breesport, NY 14816. Closing date is six weeks prior to first day of month of issue.

Calendar of AWA Activities

April 14-15, April 17-18
Linc Cundall Memorial OT DX Contest

April 30 and May 1
IHRS/AWA Spring Meet

May 1
AWA Expanded Spring Meet

May 1
AWA Museum Board Meeting

May 1
AWA, Inc. Board Meeting

May 14-15
Radio Daze 2004

August 17-21
AWA Annual Conference

November 14
AWA, Inc. Membership and Board Meeting

November 14
AWA Museum Membership and Board Meeting

Calendar of Meets

(AWA logo identifies AWA-sponsored events)

SCARS MEETING AND SWAPMEET

April 17

Southern California Antique Radio Society meeting and swapmeet begins 7 a.m. at Marie Callenders Restaurant, 160 E. Rincon St., Corona, CA. Info: Mary Curry (619) 461-9327; currycat@cts.com

IHRS/AWA SPRING MEET

April 30 and May 1

Indiana Historical Radio Society and AWA present their 33rd Annual Antique Radio Festival. The meet will be held again at the Johanning Civic Center located at 1500 North Reed Road (US 31) on the north side of Kokomo, IN. Many restaurants and motels are situated close by. A snack bar will be provided by the Civic Center. Tentative setup times are 2 p.m. Friday with swap and sell from about 4 p.m. to 8 p.m., then Saturday from 7 a.m. until about 3 p.m. There is plenty of space to set up inside the very large new facility. No outside setup will be permitted by the Center. An old equipment contest will be held for members. We encourage everyone to participate in, and witness, the operational radio displays. An auction of over 100 radios and radio related items, mostly from the collection of an IHRS member, will begin right after the awards luncheon on Saturday. Advance registration is encouraged. Contact Fred Prohl at (812) 988-1761 or indianahistoricalradio@att.net. For Kokomo info, contact Herman Gross at (765) 459-8308 or w91tt@mindspring.com. Visit the IHRS web site at www.indianahistoricalradio.org.

AWA EXPANDED SPRING MEET

May 1

Now an indoor event to be held at the Bloomfield Elementary School, located just around the corner from the A.W.A. Electronic Communication Museum Annex at 6910 Rt. 5 & 20 (intersection with Rt. 444). All activities will be indoors, including the flea market, the museum excess inventory sale and auction, the commercial vendors, and new and expanded programs and demonstrations. See schedule of activities in "Museum News" column. Annex and Museum tours will be scheduled as usual. Opening is at 8:00 a.m.; sellers can set up at 7:00 a.m. Tables will be available @ $3.00, but there will be no early selling. Pre-registration not necessary. For more info, including commercial vendor opportunities, contact Meet Chairman Bob Roberts, WA2QAU, 1982 Wheatland Center Rd., P.O. Box 58. Scottsville, NY 14546 or Museum Curator Ed Gable, K2MP, (585) 392-3088; k2mp@eznet.net.

AWA MUSEUM BOARD MEETING

May 1

1 p.m. at same location as AWA Expanded Spring Meet.

AWA, INC. BOARD MEETING

May 1

About 2 p.m. (following Museum board meeting and at same location).

RADIO DAZE 2004

May 14-15

Sponsored by Northland Antique Radio Club, AWA, and Pavek Museum of Broadcasting. At Comfort Inn of Plymouth, I94 and Highway 55, Plymouth, MN (763) 559-1222. Flea market be-

gins at dawn on Friday and Saturday. Auctions, contest, banquet. Saturday program features a talk by Jim Bragg, NBC cameraman and collector extrordinaire. Pavek Museum garage sale. Free admission to the museum with Radio Daze admission. For more information, visit the NARC website at www.geocities.com/TelevisionCity/4544/

ECARC ANNUAL SWAPFEST
May 15

Sponsored by East Carolina Antique Radio Club. 8 a.m. to 3 p.m. at the Kiwanis Club, 177 Forelines Rd., Winterville, NC. Free admission. Inside tables $15.00, outside tables $10.00. Contact; Herman Schnur K4CTG, 3205 Brick Kiln Rd., Greenville, NC 27858; 252-752-2264; bschnur@cox.net

"MORSE TO MARCONI" AUCTION
June 3

Bonhams, an international auction house, will be conducting a sale of equipment and memorabilia from the dawn of telecommunications. These items from the "19th Century Information Highway" will be offered at the firm's Knightsbridge, London, location. Hardware, manuscripts, books, pamphlets and ephemera from the telegraph, telephone and wireless industries will be offered. The hardware includes such iconic items as wire from Morse's first long-distance transmission in 1838 and Cooke and Wheatstone's 1840 telegraph receiver—the latter being the earliest example of such equipment in private hands. Among the large collection of significant manuscripts are a record of the first eight months of revenue from Morse's 1844 Baltimore to Washington telegraph line and an eyewitness shipboard account of the laying of the Atlantic Cable in 1858. Items from the books and ephemera categories include the true first issue of the first book on the telephone (*The Telephone*, by Amos Dolbear) and the top copy of a message from Queen Victoria to President Andrew Johnson thanking him for his message inaugurating the first cable service between Europe and North America. For more information about this important auction, visit the Bonhms web site at www.bonhams.com

RADIOACTIVITY 2004
June 4-6

Presented by the Mid-Atlantic Antique Radio Club. Again this year, the meet is being run on a Friday through Saturday format. No events are scheduled for Thursday. The theme this year is Zenith. There will be a special Zenith auction Friday evening to liquidate the fine Transoceanic collection of Greg Pease. As always, look for the big flea market (starts Friday morning), Old Equipment Contest, seminars, and awards banquet. The walk-around "junque" auction takes place Saturday afternoon and our big auction winds up the meet on Sunday. Location, same as last year: the Sheraton College Park in Beltsville, MD, between Baltimore and Washington, DC. Off I-95 at exit 29B, then turn left at first light. Hotel reservations: (301) 937-4422. Info: Lynne Bushong at P.O. Box 274, Fulton, MD or (301) 206-5353—or visit www.maarc.org

AWA ANNUAL CONFERENCE
August 17-21

At Rochester Institute of Technology Conference Center (formerly Thruway Marriott). I-90 Exit 46 to I-390 North to NY 253 West to NY 15 South. RIT Info Number (585) 359-1800. Also see CONFERENCE PREVIEW section in this issue.

AWA, INC MEMBERSHIP AND BOARD MEETING
November 14

AT RIT Conference Center (see above). Membership meeting at 11 a.m. All members welcome. Board meeting follows.

AWA MUSEUM MEMBERSHIP AND BOARD MEETING
November 14

Same location as above. Membership meeting (all members welcome), followed by board meeting, begins at conclusion of AWA, Inc. board meeting.

Recurring Meetings & Events

•Antique Radio Collectors of Ohio—meets first Tuesday of each month at 2929 Hazelwood Ave., Dayton, OH (4 blocks east of Shroyer Rd. off Dorothy Lane) at 7 p.m. Also annual swap meet and show. Membership: $10.00 per year. For more info, contact Karl Koogle: mail to above address; phone (937) 294-8960; e-mail KARLKRAD@GEMAIR.COM

•California Historical Radio Society—For info on current meetings, call the CHRS hotline: (415) 821-9800.

•CARS, the Cincinnati Antique Radio Society—Meets on the third Wednesday of each month at The United Methodist Church, 7388 E. Kemper Rd. For more information contact Tina Hauke at (513) 247-9406.

•Carolinas Chapter of the AWA—Hosts four "mini-swap-meets" each year (in January, May,

July and October) plus an annual conference, "Spring Meet in the Carolinas," on the 4th weekend in March. Executive committee meets approximately quarterly. For more info, visit the web site at CC-AWA.ORG or contact Ron Lawrence, KC4YOY, Chapter President, P.O. Box 3015, Matthews, NC 28106-3015; phone (704) 289-1166; e-mail kc4yoy@trellis.net

•Central Ohio Antique Radio Assn.—Meets at 7:30 p.m., third Wednesday of each month at Devry Institute of Technology, 1350 Alum Creek Rd., Columbus. (1-70 Exit 103B). Contact: Barry Gould (614) 777-8534.

•Delaware Valley Historic Radio Club—Meeting and auction begins 7:30 p.m. on the second Tuesday of each month. Location: Telford Community Center on Hamlin Ave. in Telford, PA. Annual dues: $15.00, which includes a subscription to the club's monthly newsletter *The Oscillator*. For more info contact Delaware Valley Historic Radio Club, P.O. Box 5053, New Britain, PA 18901. Phone (215) 345-4248.

•The Downer's Grove (IL) Park District Museum sponsors a monthly "Collector's Hour." Participants have the opportunity to display collections at the facility for several weeks before making their individual presentations. The event is open to the public with no admission charge. The museum has also begun to sponsor a yearly "Collector's Fair." For more info, contact Mark Harmon, The Downer's Grove Park District Museum, 831 Maple Ave., Downer's Grove, IL, 630-963-1309, fax 630-963-0496, mharmon@ xnet.com.

• Houston Vintage Radio Association (HVRA)—Meets monthly on the second Tuesday (April thru Oct) at Bayland Park, 6:30-9 PM in SW Houston. March and November meetings are held on Saturdays at the American Legion Hall off Alba Street in North Houston at 9 AM. Each meeting includes an auction and program. Two one day auctions are held each spring and fall. An annual convention is held in February. A newsletter, *The Grid Leak*, is published monthly. Membership is $20/yr. Web site: www.HVRA.org. Write: HVRA, PO Box 31276, 77231-1276 or call Bill Werzner 713-721-2242 (e-mail: mingqi53@sbcglobal.net).

•Hudson Valley Antique Radio & Phono Society—Meets third Thursday of month, 7 p.m. Meeting, swap meet, and membership info: Peter DeAngelo, President, HARPS, 25 Co. Rt. 51, Campbell Hall, NY 10916. (914) 496-5130.

•Indiana Historical Radio Society—Meets quarterly in Feb., May, Aug or Sept and Oct. Flea market and Old Equipment Contest at all events. Auctions at all but Feb meet. The *IHRS Bulletin* has been published quarterly for the past 32 years. For meet details and information about the club and our Indiana Historic Radio Museum in Ligonier, IN see our Web site at www.indianahistoricalradio.org or contact Herman Gross, W9ITT, 1705 Gordon Dr., Kokomo, IN 46902-5977, (765) 459-8308, w9itt@mindspring.com

•London Vintage Radio Club—This Ontario, Canada club meets in London on the first Saturday of January, March, May, June and November. Annual flea market held in Guelph, Ontario in September in conjunction with the Toronto club. Contact: Lloyd Swackhammer, VE3I1A, RR#2, Alma, Ontario, Canada N0B1A0. (519) 638-2827. E-mail contact is Nathan Luo at lvrceditor@yahoo.com.

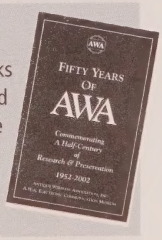
•Mid-Atlantic Radio Club—Meets monthly, usually the third Sunday of the month at the New Hope Seventh Day Adventist Church, Burtonsville, MD. Contacts: President, Geoff Shearer, 14408 Brookmere Dr., Centreville, VA 20120, e-mail gshearer@cox.net; Membership Chair, Paul Farmer, (540) 987-8759, e-mail: oldradiotime@hotmail.com. Website www.maarc. org

•New Jersey Antique Radio Club—Meets second Friday each month, 7:30 p.m. Holds three

AWA Life Memberships Are Now Available

Cost: $400 (U.S.), $500 (elsewhere) . Send your check to AWA Secretary Joyce Peckham, Box E, Breesport, NY 14816. Phone (607) 739-5443. E-mail:awapeckham@ aol.com.

50th Anniversary Commemorative Booklet



Our 50th anniversary commemorative booklet *Fifty Years of AWA* has received high marks from almost everyone who has seen it. We still have a stock of this profusely-illustrated 60-page AWA history available for those who would like extra copies or those who were not members at the time of distribution and didn't receive one. Cost is $7.00 per copy postpaid, no limit. But once they're gone they're gone—so act now if you are interested! Send your check to Joyce Peckham, Box E, Breesport, NY 14816.

annual swap meets. Contact (send SASE) Phil Vourtsis, 13 Cornell PI., Manalapan, NJ 07726, (732) 446-2427.

•Northland Antique Radio Club—hosts four events with swap meets each year (in February, May, September and November) including an annual conference, "Radio Daze," for two days in mid-May. Annual dues are $12.00, which includes a subscription to the club's quarterly newsletter. For more info, visit our web site at www.geocities.com/northland.geo/; contact Ed Ripley at (651) 457-0085; or write NARC, P.O. Box 18362, Minneapolis, MN 55418.

•Northwest Vintage Radio Society—Meets second Saturday of each month (except July and August), at or about 10 a.m., at Abemathy Grange Hall, 15745 S. Harley Ave., Oregon City, OR. Members display radios, exchange information. Guests welcome at all meetings and functions, except board meetings. For info, write the Society at P.O. Box 82379, Portland, Oregon 97282-0379.

•Oklahoma Vintage Radio Collectors—Oklahoma City Chapter meets second Saturday each month at Hometown Buffet, 3900 N.W. 63rd St., Oklahoma City, OK. Visitors welcome. Dinner/socializing, 6 p.m.; meeting at 7 p.m. Membership, $12/yr., includes monthly *Broadcast News*. Info: SASE to OKVRC, P.O. Box 50625, Midwest City, OK 73140-5625; or contact Fred Karner at (405) 769-4656 or fkarner@cox.net; or visit our web site at http://members.cox.net/ okvrc/

AWA NETS

(EASTERN TIME)

PHONE

SUNDAY:
7237 kHz, SSB, noon (NCS:WA4IAM); 3837 kHz, AM 4:30 p.m. (NCSs: KA2J & W2AN)
TUESDAY:
14274 kHz, SSB, 2:30 p.m. (NCSs: KC3YE and W0FXY); 3837 kHz SSB, 8 p.m. (NCS: WB2SYQ)
MONDAY-WEDNESDAY-FRIDAY:
The AWA Bruce Kelley HF Net
3867 kHz, SSB, 9:30 a.m. (NCS: W2OBJ)

CW

DAILY, 4 p.m., 3588 or 7050 kHz. Protocol, informal. Check both frequencies for activity and join in, or call AWA de (your call) and see what you stir up. First WEDNESDAY of each month, 8 p.m., 7050 kHz

2-M REPEATER (Rochester Area)

MONDAY, 7:30 p.m. (NCS: K2GBR)
Receive 145.290 MHz / Transmit 144.690 MHz

•Ottawa Vintage Radio Club—Meets monthly (except June and July) in the Conference Room, *Ottawa Citizen*, 1101 Baxter Rd., Ottawa, Ontario, Canada. Contact: Lea Barker at (613) 829-1804 or check www.ovrc.org. Membership: $10 Canadian/yr.

•Pittsburgh Antique Radio Society welcomes visitors to our Saturday flea market/contests in March, June, September, and December. An auction is included in September, and our annual luncheon/program is held the first Saturday in December. Our newsletter, *The Pittsburgh Oscillator*, is published quarterly. website: www.nb.net/~schaefer/pars.html For directions, specific dates, information call President Bonnie Novak at 412-481-1563 or write to Karl Laurin, 8111 Sally, White Oak, PA 15131.

•Society for Preservation of Antique Radio Knowledge—Meets at 7:30 p.m. the second and fourth Tuesdays of each month in the party room at Cassano's Pizza Parlor, 1700 East Stroop Rd., Kettering, OH. Membership, $18/year. Write SPARK Inc, P.O. Box 292111, Kettering, OH 45429; e-mail sparkinc@juno.com or call John Pansing at (937) 299-9570.

•Texas Antique Radio Club—Meets alternate months in Kyle and Shertz, TX. Contact: Ron Manning, President TARC, 133 East Huisache Ave., San Antonio, TX 78212. Phone (210) 734-6831; e-mail ronmeg@gateway.net; website www.gvtc.com/~edengel/TARC.htm

Service Sources Available

The AWA Source Sheet is a listing of parts suppliers and services for the radio collector. Cost: only a business-size self-addressed stamped envelope to AWA, Box E, Breesport, NY 14816.

AWA VHS Video Programs

The Antique Wireless Association has available several historical documentaries to loan to affiliated organizations for club meetings and programs. There is no charge for this service other than return mailing cost. For info on loan conditions, to make reservations, or just inquire, contact Ed Gable, Curator, AWA Electronic Communication Museum, 187 Lighthouse Rd., Hilton, NY 14468. The following are available:

V-2 — "Electrons on Parade." 18 min. 1938 movie made at RCA's Harrison Plant showing production lines with closeups showing receiving tubes, including a short sequence on transmitting tubes. (Very rare movie.)

V-4 — "The British Receiver." Documentary of the AWA/BVPS meet with visit to Marconi's Chelmsford plant, the British Science Museum, and ending with series of collectible British re-

With the Chapters

CC-AWA CHAPTER NEWS

I'm sitting at the computer writing this on Sunday morning, the day after the CC-AWA Annual Conference. What a great 3 days! when I got home Saturday afternoon I was as tired as I think I have ever been, but it was fun and we will do it again. I'm not going to do a full report here since we've been promised a double page spread in the next *OTB* for a full meet report.

On Thursday afternoon we had our annual CC-AWA membership meeting. the main topic of discussion was club finances. The cost of doing antique radio club "business" is going up every year. now that our club's database is computerized, we can generate graphs to help make it easy to see what's going on. The graph shows two converging lines.

The one representing the club bank account is going down slowly, and the one showing club expenses is climbing slowly. The problem is, if something is not done soon the two lines are going to cross and then we're going to have a problem.

Ever since the club was formed, we have given all dues-paying members free admission to the Annual Charlotte Conference. We only have about 45 members, but if all of them took advantage of this it would mean $450 of lost income. So the benefit is most likely going to end with this year's meet.

It was also suggested that, at $10.00, club dues are too cheap. The Board of Directors will be discussing this at our next meeting, along with updating our By-Laws. Several vendors talked to me during the meet saying that we should increase the vendor space rental.

There are two sides to this. One is that the vendors are making money from the event and should be willing to pay more; the other is that it's the vendors most of the attendees come to see and if vendor space rental is too much, the vendors won't be there. This is going to require a lot of research.

The bottom line is if you enjoy what the club does: hosting a world-class annual conference; publishing a really nice newsletter; hosting four mini/swap meets each year; publishing a web page; then the money to do it is going to have to come from somewhere.

The next event of the CC-AWA calendar is our Spring Swap Meet at Spencer Shops, the North Carolina Transportation Museum, on Saturday May 8th. As always admission is FREE, Vendor set-up is only $5. Remember, these are Saturday morning events that start early, between 7 and 8 a.m., and are all done before noon. Don't show up at 11 o'clock and expect to see anything except folks packing up. That's just the way these things work.You can find detailed driving directions to this and info on all CC-AWA events by visiting our web page at www.cc-awa.org.

I'd like to thank Judy and Barker Edwards for their heroic effort to produce that latest issue of our newsletter,"The Carolina Antenna." Judy has been very sick and has spent weeks in the hospital in the last several months. But she insisted on working on the newsletter while still confined to bed, and also instructed Barker on how to get the printing done properly.

Judy and Barker along with Laura Carter make up our crack newsletter committee. Thanks for a GREAT job guys!

Ron Lawrence
CC-AWA President

ceivers. (VHS program transferred from slides.)

V-5 — "The Early Years." Historical documentary narrated by Clarence Tuska telling of the early years of amateur radio, founding of the ARRL and WWI military radio training school. (VHS program transferred from slides.)

V-6 — "The Key." History of the telegraph/radio key covering early hand keys, semi-automatics and commercial types. Script by Lou Moreau, W3WRE. (VHS program transferred from slides.)

V-9 — "The Transatlantic Tests and 1BCG." Rare documentary/photographs showing early amateur operation leading to famous 1921 transatlantic tests.

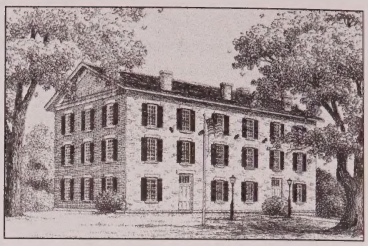
V-12 — "Those Wonderful Magazine Covers." The story of radio through magazine covers. Colorful with period music.

V-15 — "The WHAM Story." Details development of a pioneer radio station in Rochester, NY. Program developed with assistance and recollections of Art Kelly, the station's former general manager.

V-16 — "The Charles Herrold Story." Video prepared by Mike Adams who donated this copy to the AWA. It documents the work of broadcasting's Forgotten Father who started broadcasting in 1912.

MUSEUM NEWS

Visit us on the Internet at http://www.antiquewireless.org



OFFICERS

Director
Thomas Peterson, Jr.

Deputy Director
Allan Pellnat, KX2H

Secretary
Robert Perry W2T1X

Treasurer
Stanley J. Avery, WM3D

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Prof. William Hopkins, AA2YV
Lauren Peckham*
Allan Pellnat, KX2H*
Robert Perry, W2TIX
Thomas Peterson, Jr.*
Ronald Roach, W2FUI
Ronald Walker, WA2TT
Morgan Wesson

**also on AWA Inc. Board of Directors*

MUSEUM CONTACT

For all inquiries about the Museum and its operation, contact Edward M. Gable, Curator, 187 Lighthouse Rd., Hilton, NY 14468. Phone: (585) 392-3088, e-mail: k2mp@eznet.net.

The A.W.A. Electronic Communication Museum is an IRS 501(c)3 charitable organization.

Greetings from your museum crew. Those of you living in the Northeast will not be surprised if I tell you this has been an incredibly tough Winter. Record cold, record snowfall, we've had it all this year. This has also had an impact on the crew's ability to get much work done. Bad travel conditions and our inability to get the annex and museum up to a workable temperature were weekly problems. At one time there was a coating of ice over the entire wall on the third floor of the museum.... on the inside! None the less, progress was made in some areas.

We needed more electrical power in the latest addition to the Annex, what we call the TV room. Facilities manager Jack Roubie, K2JDD, has been bending electrical tubing and hanging breaker boxes to facilitate the quest for more power. The basic power into the building has withstood three upgrades over the years thanks to forward thinking folks who made the entrance panel big enough. That person seems to have been ex-AWA president Bruce Roloson who was also a mover and shaker in the power company.

The workshop and library area have been warm enough, and taking advantage of that were the communication equipment chaps. They worked on some of our Collins gear as well as fixing up

RECENT MUSEUM DONORS

- Ralph Williams Estate.....Early HRO, SW-3s, nice Home brew RX
- Chris Fandt.....US Army in WW2, 3 book set
- George Pierce.....AC SW-3
- Tom Rosica W2GIR.....Several am/fm sets, Bogen 50W Amp
- John Zima.....Collins 51J3/R-388
- Virginia Hartley.....Zenith A385E
- Carol Murzin.....RCA RZD311
- Mike Raide W2ZE.....James Millen 9093 oscilloscope
- Robert Roberts WA2QAU.....Studio grade turntable
- Elmer Wagner W2BNJ.....RCA Direct TV 12 gHz system
- William Hopkins AA2YV.....Hallicrafters SX-71, Eico 720
- Harris Corporation/RF Div...Early RF-301 HF SSB Xcvr. RF-805 Amplifier
- WROC TV Rochester.....RCA Color TV Studio Camera TV-45
- Stan Rubin N2GLA.....DX-100, Kenwood 2 mtr FM, More...

Cash Donations:

Harry Sadler VE1CDT

some nice old consoles. We also took in a few repair jobs for folks out in the community who had urgent need for tube type equipment repair. I think this helps with public relations and also brings a few dollars into the bank.

Also working to restore our artifacts are Roy Wildermuth, W3RLW, and Duncan Brown, K2OEQ. Duncan's strength is that he is military-trained on radio teletype equipment of the era that we are most interested in. Right now he has made four of our vintage RTTY printer/perforators fully operational and is just about ready to put back into service a T-195/R392 set up. Their motto is "Real radios run on motors." And when you see and hear a T-195 in full autotune and a room full of dynamotors running... you'll believe it. Wait until you see their demo at the May 1st Spring Meet!

I'm sad to report that a good friend, a loyal and hard working AWA member, and our museum Deputy Director is leaving us. Allan Pellnat, KX2H, is moving to the Carolinas. He has taken on many a special task for both the AWA and the Museum, and has excelled in all endeavors. Allan is a skilled, thorough and avid researcher who can seek out the tiniest detail in a library stack. The search for a replacement Museum Deputy Director continues.

Let's take a minute to welcome a new Annex volunteer, Mr. Paul Brenner. Paul likes to restore vintage equipment and just did a splendid job of bringing a 1925 Silver-Marshall back to life. Look for it in the museum. Also new to the museum will be a dandy little spark key, an AWA type R668A with a large and splendid AWA logo emblazoned on the base! Who could not want that in the collection? In this case the AWA stands for Amalgamated Wireless of Australia. It is a very nice example of a period spark key and the AWA logo makes a wonderful conversation point as well. Thanks to Tom Perera, W1TP, a good friend to the AWA and past Editor of the *AWA Review*, for brokering the acquisition of the key.

Even though the museum is full of old stuff, (yes, I'm including myself) we're right up to date with PC technology. Roy Wildermuth, W3RLW, just finished installing a new wireless network for the PCs. We can now carry our laptops to any point in the annex to facilitate the inventory process and, look, no wires at the old wireless association.

(continued on page 15)

NEW VENUE FOR EXPANDED SPRING MEET
May 1, 2004 at the Bloomfield, NY Elementary School—Be there!

After twenty years of high risk of bad WX, the Antique Wireless Association is moving the annual Spring Meet indoors and expanding the program. The decision has been made to move the AWA Spring meet just around the corner from the Annex to the Bloomfield Elementary School on Route 444. All events will be indoors. These will include the flea market folks, the museum excess inventory sale and auction, a member's auction and commercial vendors.

You will also want to attend the new and expanded programs and demonstrations. Scheduled programs include one on the Care and Repair of Wood cabinets by Andy Wegman, another will be a show and tell by Ron Frisbie on his personal radio museum, and finally a wonderful demonstration of BIG tesla coils by Ed Wingate.

All morning there will be a special demonstration of Military RTTY equipment by museum staffers Roy Wildermuth, W3RLW, and Duncan Brown, K2OEQ. Of course, the usual Annex and Museum tours will be scheduled in the afternoon.

The Meet is open to the public—members and non-members alike. Admission is a mere three dollars. Sellers pay an additional three dollars for an inside flea market table. Doors open at 7:00 a.m. for sellers to set up and the event starts at 8:00 a.m. See the full schedule of activities below. There will be plenty of room for smaller meetings if groups such as the AMers want to get together. Spread the word about this new, exciting and expanded AWA Spring Meet format. Questions to edgable@awamuseum.com

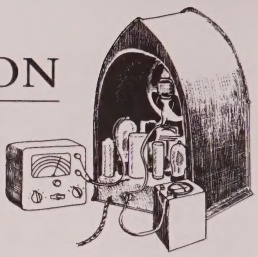
SCHEDULE OF ACTIVITIES

7:00 a.m.	Sellers may set up starting at 0700
8:00 a.m.	Meet officially opens for AWA Members and to the public
8:30 a.m.	Our popular sale of excess items from the museum begins
9:00 a.m.	Start of vintage RTTY demo by Roy Wildermuth and Duncan Brown. Drop by anytime, runs all morning.
9:00 a.m.	Care and Repair of Wood cabinets by Andy Wegman
9:45 a.m.	Slide program. Ron Frisbie shares his personal Radio Museum with us all. Don't miss this one.
10:30 a.m.	Auction of better museum excess items followed immediately by auction of member items. See Auction signs for details
Noon	Hang on to your hats and see and hear the BIG Tesla coil demonstration by Ed Wingate. Pacemaker users—ASK
1 to 2 p.m.	Visit the AWA Museum Annex for guided tour.
2 to 4 p.m.	Visit the world famous A.W.A. Electronic Communication Museum

All day long: Visit coffee and snack area. Buy *AWA Reviews*, membership pins, coffee mugs, CD's and more. Groups—plan ahead for group get togethers, lunch breaks and the like.

EQUIPMENT RESTORATION

EDITED BY **KEN OWENS**, 478 SYCAMORE DR., CIRCLEVILLE, OH 43113
radiowd11@yahoo.com
PLEASE SEND CORRESPONDENCE DIRECTLY TO THE ABOVE ADDRESS, INCLUDING SASE FOR REPLY.



A Solid State Filter Choke or Field Coil Replacement

This month's contribution comes from Leigh Bassett, W3NLB (Laurel, MD). It's a circuit designed to replace the filter chokes and capacitors in sets where the originals are beyond salvage. The device should be especially useful for replacing open chokes in radios like the metal-box Atwater Kents. It can be built on a small PC board and installed in the power pack case after the original bad components have been removed. —dko

This simple circuit provides a regulated output up to 350 volts and 100 mA. Ripple content of the output is essentially zero. Substituting the circuit for a filter choke or field coil in a radio costs less than $2. The output is set by changing a single resistor, or a variable resistor can be used.

At the heart of this high-tech marvel is the Supertex LR8N3 three-terminal regulator. Rated for input up to 450 volts and output up to 400 volts, it can supply up to 10 mA of current. The device comes in a TO-92 plastic transistor package. Increased current capacity is provided by using the LR8 output to drive the base of a TIP50 power transistor, housed in a standard TO-220 package. With a minimum beta of 30 for the TIP50, the combination can supply up to 100 mA continuously.

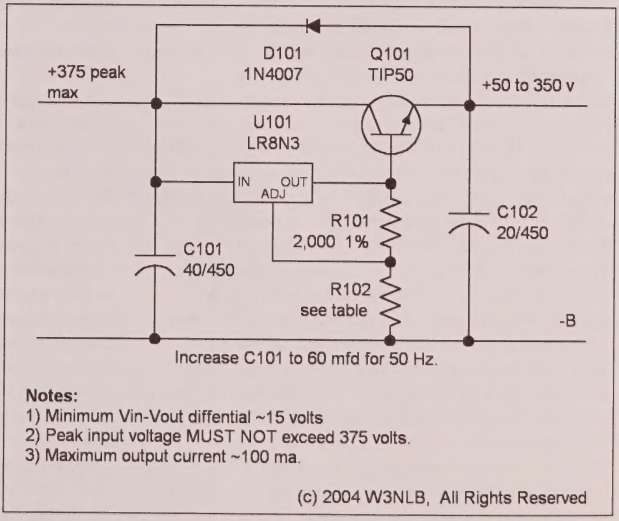
In most applications, the pass transistor will not require a heat sink. For example, in a circuit with 50 volts differential across the TIP50 and 100 mA load, the pass transistor is only dissipating 5 watts. The TIP50 is rated 40 watts dissipation.

The metal tab of the TO-220 case is the collector, which is connected to the DC input in this circuit. If a heat sink is required, a suitable insulated mounting kit must be used.

The actual current capacity from the supply depends on the input-output voltage differential across the LR8 and the amount of current which it must supply to the pass transistor. The LR8 can supply up to 10 mA, but it is protected from both over-current and over-temperature conditions by internal circuitry.

The minimum input-output voltage differential across the LR8 is 12 volts. Therefore, the input voltage at the low-point of the ripple should exceed the desired output by at least 15 volts, allowing for the base-emitter drop in the pass transistor. Increase the size of the input capacitor if needed to achieve this.

Note the limit of 375 volts peak input to the regulator. This is measured at the crest of the ripple waveform and insures that the components will not be damaged in the event of line voltage



Leigh Bassett's hi-tech filter network or field coil replacement.

PARTS LIST

Ref	Part No.	Mfr. and Description	Vendor	Price
D101	1N4007	Fairchild 1000 PIV/1A rectifier	Mouser**	$0.05
Q101	TIP50	ST Micro NPN HV power transistor	"	$0.80
R101	RN55D	Vishay 2kΩ 1/8w 1% resistor	"	$0.16
R102	RN55D	Vishay 1/8w 1% resistor*	"	$0.16
U101	LR8N3	Supertex HV 3-terminal regulator (TO-92)	"	$0.82

Total parts costs = $1.99
Prices are single-piece online as of 12 February 2004.
* Value from table above.
**Mouser Electronics - www.mouser.com
Data sheets available at onsemi.com (TIP50) and supertex.com

excursions.

As a replacement for a filter choke or field coil, the active regulator provides 60 Hz ripple suppression in excess of 60 dB with only 1 μF of capacitance on the output. In the circuit presented here, the value should be greater than 66 dB due to the larger output capacitor and the 120 Hz ripple frequency.

Output voltage is determined by the value of R102. The table below gives values for various outputs. The supply can also be made adjustable by replacing R102 with a 500kΩ potentiometer in series with a 75kΩ 1% resistor.

Output Voltage	R102-kΩ
350	572
325	531
300	490
275	449
250	408
225	367
200	326
175	285
150	244

MUSEUM NEWS, *continued from page 13*

When the museum opens on May 1st one of the new exhibits will be the first amateur transistorized transmitter. This well-recognized and well-documented artifact was for some reason well hidden by museum founder Bruce Kelley. To the rescue was Jack Roubie, who built a very clever display that allows the viewer to observe the top, bottom and sides of the artifact as it remains safely inside a dust free environment. The viewers can also see copies of the documentation describing the transmitter and see how it was actually used.

This continues what I hope you have noticed to be a museum theme. I want you to be as close as you can to the actual artifacts. I want you to see and hear them work and when possible to flip a switch and turn a knob. This is far from the thinking at most museums. Our open plan prohibits bus loads of school kids from running around and we do unfortunately lose a few paying tours that way.

While on the museum visitation subject, we just squeaked by in scheduling museum guides for this year. I regret that we are losing some of the wonderful old timers who have guided for more years than I've been around. We would love to see more local members stop by and give no more than two or four hours a season to be a guide. You'll get free training and at the end of day all the ice cream you can eat. What a deal.

A great deal of time has been put into the Spring Meet this year. Now bigger and better than ever with two major improvements. First, the venue is all inside and out of the unpredictable upstate weather found in May. Second, the meet has been expanded to include programming and members are allowed to bring items to the Auction. Please look for further details in this column and mark your calendars now for the May first event. I'll see you there. S'long from your museum crew.

Ed Gable

Ed Gable K2MP/W2AN
Museum Curator

AWA Annual Conference

RIT Conference Center (formerly Thruway Mariott), Rochester, NY
August 17-21, 2004 Theme: *Broadcasting*

WELCOME BACK! At the 43rd annual conference, collectors and history enthusiasts will convene, exchange equipment, and learn more about the development of radio and electronics. If you have never been to the yearly "reunion," why not give it a try? Rochester (Henrietta) is just north of upstate New York's beautiful Finger Lakes region, easily reached by car or plane. The site is 26 easy miles from the AWA Museum at Bloomfield.

Advance registration is encouraged to facilitate preassembly of registration materials and preassignment of flea market spaces. Your materials for advance registration will be included in the July issue of *The OTB*. There will be unlimited registration at the door.

The conference site is The Rochester Institute of Technology Conference Center. Formerly the Thruway Marriott Hotel, This is the same facility where we've been running the conference for many years. It offers special nightly rates ($89.00 for a single or double) on a group of rooms that will be reserved for the conference until August 2, 2004. It's first-come-first-served, so get your reservation in early. For info or reservations, call (585) 359-1800. The conference center has restaurant facilities, and other lodging and eating places are nearby.

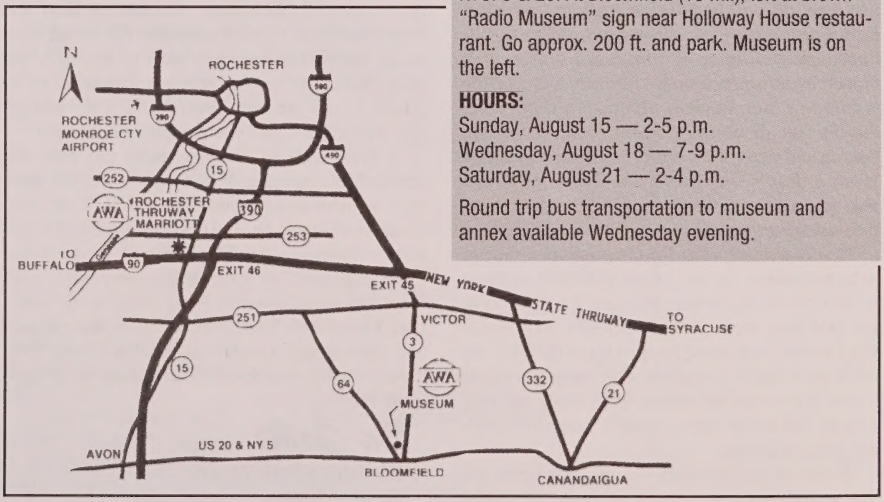
The hotel is reached from Exit 46 of the New York State Thruway (I-90): take I-390 north to NY 253 West, to NY 15 South. For visitors arriving by air, the location is about seven miles or 15 minutes from the airport. There is shuttle service, 6 a.m.-11 p.m. (specify the RIT Conference Center). If you take a cab, make sure the driver understands that you are NOT going to the RIT campus, but rather to the RIT Conference Center, which was formerly the Thruway Marriott Hotel.

Conference Chairperson
HUGH DAVEY

Program Chairperson
LAUREN PECKHAM

Registration
JOYCE PECKHAM

Contest Coordinators
GEOFFREY BOURNE
CHRIS BACON



AWA ELECTRONIC COMMUNICATIONS MUSEUM
VILLAGE GREEN, BLOOMFIELD, NY

Refer to map at left. Directions from hotel: Right (south) on Rt. 15. At Avon (9.5 mi.), left (east) on RTS. 5 & 20. At Bloomfield (16 mi.), left at brown "Radio Museum" sign near Holloway House restaurant. Go approx. 200 ft. and park. Museum is on the left.

HOURS:
Sunday, August 15 — 2-5 p.m.
Wednesday, August 18 — 7-9 p.m.
Saturday, August 21 — 2-4 p.m.

Round trip bus transportation to museum and annex available Wednesday evening.

PROGRAMS

THEME: BROADCASTING

AWA MEMBERS' FORUM
Discussion of activities led by President Geoff Bourne

WRITING RADIO HISTORY
Presenter: Bart Lee

KEY AND TELEGRAPH SEMINAR
Moderated by Tom Perera

MOONLIGHT RESTORATION FORUM
Hosted by Marc Ellis

EARLY RADIO DETECTORS: A DETAILED DESCRIPTION
Presenter: Brian Belanger

THE SLIDE WIRE BRIDGE: HISTORY AND DEMONSTRATION
Presenter: Dale Goodwin

LIEBEN AND RIESZ: DEVELOPERS OF THE LRS RELAY TUBE
Presenter: Franz Pichler

CHARLES HERROLD: PIONEER RADIO BROADCASTER
Mike Adams

REVIEW OF AMATEUR OPERATION
John Rollins, W1FPZ

PRE-1912 WIRELESS AND ELECTRICAL APPARATUS
Discussion and Display of Early Devices
Moderated by Lauren Peckham

WIRELESS INTERCEPTION AND ENIGMA DECODING OPERATIONS AT BLETCHLEY PARK
Tom Perera

Among the many other activities in store for you are the outdoor flea market, indoor book fair, ladies' luncheon, old equipment contest, annual sightseeing excursion, bus trip to AWA museum and annex. We plan a vacuum tube and main auction to include broadcast receivers, amateur equipment and more! The awards banquet will be on Friday evening and the Finale Luncheon Saturday at noon.

COMPLETE CONFERENCE SCHEDULE AND REGISTRATION MATERIAL WILL BE INCLUDED IN THE JULY ISSUE OF *THE OTB*

— See next page for Old Equipment Contest categories —

BY GEOFFREY BOURNE AND CHRIS BACON
CONTEST COORDINATORS

THE OLD EQUIPMENT CONTEST
2004 AWA CONFERENCE
THEME: BROADCASTING

We all know how the arrival of radio in the home changed people's lives. This year we will be looking at the history of radio from the other side of the microphone—from the broadcaster's point of view.

THE THEME CATEGORIES

1. TRANSMITTERS
We all know that the transmitter is the most important piece of equipment at the radio station. For without it you could not be on the air. Through the years the transmitter has evolved and improved. So bring in an early example, or just part of a transmitter, to show. For example: final tubes, exciters, modulators… manufactured by RCA, Western Electric, Gates, Harris, Collins,…

2. MICROPHONES
The microphone, too, has evolved over the years. We started off with the carbon mike, then the crystal and the ribbon mike. There are too many different types to list. So bring in a collection or just one and enter in this category. A nice RCA 77DX would make a fine entry.

3. STUDIO EQUIPMENT
This was the equipment used to monitor and direct a performance or a broadcast. Here is where you would enter a control board or other control room equipment.

4. RECORDING EQUIPMENT
Over the years there have been many changes in how sound has been recorded. First we had the transcription disk, followed by the wire recorder and then magnetic tape. This is the category to show recording equipment. So bring in a record lathe, reel to reel tape recorder, cart player or any other broadcast quality machine.

5. STUDIO ACCESSORIES
At the station there were a lot of small items that were used during a broadcast. The "On Air" light,"Recording in Progress" light, Cue Cards and so on. Bring in a fine example and enter here. Anyone have a set of NBC Chimes?

6. OPEN CATEGORY
For any other piece of broadcast equipment we may not have thought of.

THE STANDARD RECEIVER CATEGORIES

7. PASSIVE RECEIVERS
Any detecting device, not including vacuum tubes or solid state amplifying devices whose purpose is to convert radio energy into intelligent signals.

8. 1920s SUPERHET RECEIVERS.
Any receiver which employs the superheterodyne circuit and is from the 1920s can be entered here.

9. 1920s TUNED RF RECEIVERS
During the 20s, the TRF set was one of the most widely produced designs on the market. It was sold in kit form, factory assembled or built from scratch from magazine plans. This is where you would enter a Freshman Masterpiece, an AK 20 and so on.

10. 1920s REGENERATIVE AND REFLEXED RECEIVERS
Many manufacturers employed different circuits to improve the receiving capabilities of their radios. The regen and reflex are a few of many circuits that were used. Bring in a fine example of this type of radio.

11. CATHEDRALS, TOMBSTONES AND CONSOLES, 1930s AND 1940s
These are probably the best known of the antique radios. Just about everyone remembers someone in his or her family having on of these.

So bring in that Philco 90, or Zenette or any other cathedral, tombstone or console radio. We will split the category if enough entries show up.

12. RADIOS IN DISGUISE
Entries here can range from an end table radio to a lamp radio. There are many different styles and variations. Some fine examples would be a Porto bar radio, Melody Cruiser ship radio, or any radio made to look like something else.

13. PORTABLE RADIOS
Any battery-operated portable radio may be entered in this category. We may split the category into decades so a transistor set does not compete with a 1920s tube set. So bring in anything from an early portable radio of the twenties to a Zenith Transoceanic from the fifties or sixties.

14. SPEAKERS
A. HORN: Any sound reproduction device can be entered here as long as it employs a horn or bell for sound amplification.
B. CONE: When radio sets obtained greater power output levels, the magnetic speaker unit was designed with larger surface areas for better sound reproduction. There are many fine examples of this type of speaker. i.e. Tower Adventurer, Western Electric,…

15. TEST EQUIPMENT
Many people have requested this contest category and this is the fourth year it has been included. There were too many makers of test instruments to list, but a sampling would include Supreme, Superior, Hickok, Weston, Read-Rite, General Radio, Simpson, Rider, and RCA. So surprise us, bring in the unusual or the common.

16. TUBES
In this category you can display a single tube or a collection. There should be a common theme with the display, such as historical significance, technological breakthrough, etc. The display should tell a story.

THE AMATEUR RADIO CATEGORIES

17. SPARK TRANSMITTERS AND ARTIFACTS.
Do not hesitate to enter a major piece of spark equipment if you think it is rare or historically significant.

THE CONTEST AWARDS

Elle Craftsman Given in memory of Bruce Elle to a builder of a high-quality radio receiver of an old or new type.

Matlack Transmitter Given for excellence in constructing or restoring transmitting equipment.

Ralph O. Williams Display Recognizes the informational value and quality of an exhibit in the contest at the AWA conference.

Thompson Best of Show Awarded in honor of early amateur Eunice Thompson, W1MPP, for the top entry in the Old Equipment Contest at the Annual Conference.

People's Choice Awarded to the entry that receives the most favorable votes from attendees and visitors to the contest. All entries including displays are eligible for this award.

18. VACUUM TUBE TRANSMITTERS AND RECEIVERS
Some of the sets for this class are old, some not so old, most home-built. While the predominant entries have been amateur-operated, commercial equipment is welcome.

THE CRAFTSMAN CATEGORIES

19. RESTORATION OF APPEARANCE.
The purpose of this category is to display examples of rebuilding and refinishing the cabinets and containers that were used to house radio receivers. There is no requirement for a particular kind or size of set to be entered. A description of the work done will be considered an important part of the entry. The critical elementis the appearance of the radio, including woodwork, escutcheons, dials, knobs and other visual details

20. RESTORATION OF OPERATION.
This is the category for those craftsmen who artfully substitute modern components for old failures. The new electrolytic in the old can is an excellent example. Another is the transistorized

(continued on page 22)

RADIO REPRODUCERS

EDITED BY **DAVE CROCKER**, 35 SANTUIT POND RD., #4B, MASHPEE, MA 02649
PLEASE INCLUDE SASE FOR REPLY.

The Telmacophone Loudspeaker

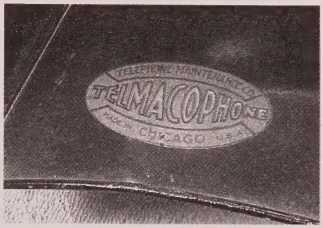
Between March of 1922 and the Fall of 1923, undaunted by weak sales of its earlier "Telmacophone" loudspeaker, the Telephone Maintenance Company of Chicago introduced two unremarkable radio sets. First came the Telmaco B-R receiver with its exposed single tube and matching 2-tube B-R amplifier. This was followed by the Telmaco "Acme" Receiver, which had a self-contained, resonating horn speaker mounted behind the front panel. It was offered in either a mahogany table cabinet or a leatherette portable case. The radio public wasn't impressed.

But Telmaco's crowning glory was the earlier radio venture, and what a piece of artwork it was! The primitive-looking Telmacophone horn speaker was priced at $20 in 1922. It was a reflected-tone type, in which the sound is "bounced" off the inside of the back of the horn bell and out towards the bell opening.

The Telmacophone had an eight-sided tin bell. The entire speaker was decorated in black with gold highlights.

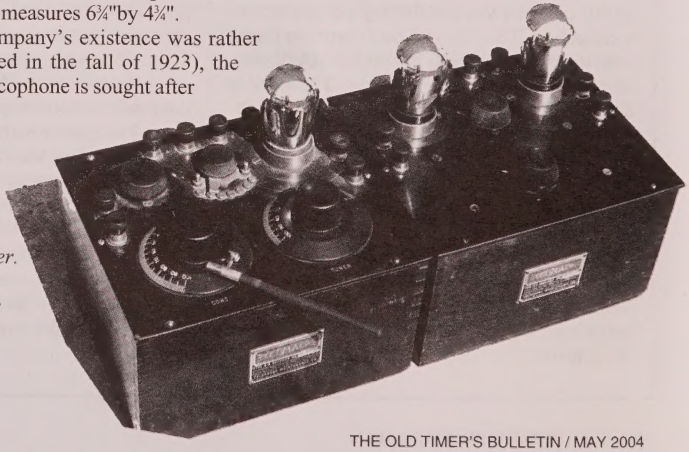
The reproducer included was a Nathaniel Baldwin Type C. The wires from the Baldwin ran down through the thin "gooseneck" tubing to two a pair of gold-painted binding posts at the rear of the base. The base was cast iron with a "web-footed" design. There were 2 versions, both with a fancy butterfly nut that allowed pivoting the horn to the desired position. In one version (pictured), the nut was located at the bottom of the gooseneck; in the other it was located at the top.

The 8-sided bell of the horn is made of tin and painted with black lacquer. The entire speaker is highlighted in gold paint. A large red and gold decal featuring the product name is located just inside the horn bell. The Telmacophone stands about 13" tall (its height is adjustable), and is 13½" long overall. Its bell is 12" wide. The heavy base measures 6¾"by 4¾".



Detail of the distinctive product logo decal located just inside the horn.

While the Telmaco company's existence was rather brief (its advertising ended in the fall of 1923), the unique web-footed Telmacophone is sought after by collectors everywhere.



The Temaco BR receiver with matching BR amplifier. Main tuning dial had an extension wand to provide vernier action.

BY PAUL BOHLANDER, W3VVS

RADIO MEMORIES FROM TWO ERAS

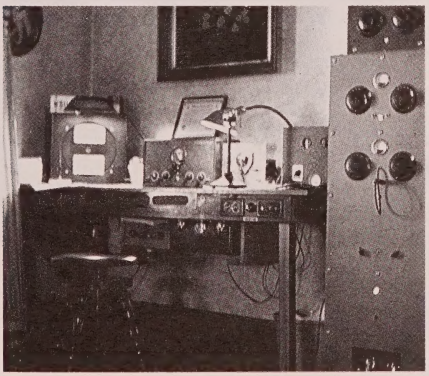
Soldering in the 1920s

During the late 1920s, much home-built radio construction was done in the evenings on the kitchen table. One of the reasons for this phenomenon was the fact that the kitchen gas stove had to be pressed into service to heat up the soldering copper (think of a soldering copper as a soldering iron without a plug). However, fellows with workshops near the laundry area in the basement might have had access to a gas hot plate normally used to heat water in the wash boiler.

My father introduced me to the soldering copper. Ours was a large piece of solid copper bar stock about one inch square and three inches long. The copper bar came to a point on one end and a long rod extended from the other end. A wooden handle on the end of the rod enabled me to hold the heated copper as I tried to solder wire to a radio part.

I used the proper soldering flux but, over time, my joints would always corrode and develop high-resistance. Later my father obtained a new solder for me that worked better. It was called "rosin core," meaning that the rosin flux was inside the solder's hollow core. This product was called "Kester Radio Solder" and came in a roll which was stored in a little round tin box when not in use.

My mother frequently objected to my working with soldering coppers on her kitchen stove, and I had to be very careful not to mess up the kitchen floor or to ruin the table top. She also didn't care for the smell of rosin flux mixing with the smell of hot waxy paraffin from the insulated bell wire I used to use for hookups. These odors had a tendency to permeate her kitchen. Sometimes, instead of soldering the bell wire, I would twist the bare wire ends together or use a small bolt and nut to fasten a connection.



The W8VVS shack in 1941.

My Uncle Henry and I shared the same birth date, August 30th. Uncle Henry owned a men's clothing store in a nearby city, and he was always good for two neckties a year—one on my birthday and one on Christmas.

One Christmas, when I was about the age to suspect that there might not really be a Santa Claus, I was really on the fence about the issue. But as Christmas drew near, I fell in with the spirit of the season and looked forward to giving and receiving gifts. In fact, on Christmas eve I set out, near the Christmas tree, a plate of cookies and a glass of milk for Santa to eat when he came to our house. Even so I went to bed that night a "doubter."

When I awoke Christmas morning, I ran downstairs to the living room. There were many wrapped presents placed around the base of the tree. My father was trying to get the series-string of colored lights to illuminate the tree by substituting a "known good" bulb in each socket in turn. Finally the defective bulb was located and the tree was aglow. Hey! The milk and cookies were gone! The glass was empty and just a few crumbs remained on in the plate.

We each started to open our presents. I got the usual kid stuff; sox, knickers, shirt, underwear (BVDs), bathrobe, slippers and, before I forget, Uncle Henry sent me a necktie. Finally all the packages seemed to have been opened, leaving just a pile of colorful wrapping paper on the floor.

But wait a moment, there was another box sticking out from under the wrapping papers—an unopened box that I must have missed! I looked at the small red and green label. It said: "To Paul from Santa!"

The box was a little longer than a necktie box. It was as wide as a necktie box, but it was three times a thick as a necktie box. I picked it up. I shook it. It rattled and was much heavier than a

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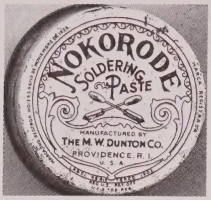


Soldering coppers like those described by author are shown on this solder flux container. Nokorode is still on the market—with updated packaging but same basic label art.

necktie. Hastily I tore off the ribbon and ripped at the paper wrapper and —OH BOY! Guess what! Out came a 100-watt, 115-volt AC American Beauty soldering iron!

W8VVS Goes on the Air as War Clouds Gather

W8VVS went on the air on April 26, 1941, at 7:15 p.m. EST—not long after I received my ticket. The station was typical of the times. The receiver was an All-Star Senior 7-tube superheterodyne built from a kit and used with a home-brew 2-tube preselector. Both equipments used plug-in coils to change bands.

The transmitter. or so-called "big rig," was housed in a wooden rack with plywood sides and a Masonite front panel. Originally the RF exciter portion consisted of a crystal-controlled type 47 oscillator, a type 46 buffer, and a pair of type 46s in the final. But like most hams, I was always looking for ways to improve and update the rig. Soon the 46s in the final were replaced with a pair of new Isolantite-based Hytron 6L6GX tubes. Power input remained at 60 watts.

Metering was accomplished by means of Readrite panel meters purchased at Allied Radio in Chicago for 73 cents each! The high-voltage plate transformer was a Thordarson "Ham Special," which was rated at 600 volts each side of center-tap at 200 milliamperes. It sold for $4.95 at Allied. The modulator tube lineup consisted of a type 75 speech amplifier, a type 76 amplifier, a type 42 triode-connected driver stage, and two type 46s as Class B modulators.

Mercury-vapor rectifiers were used in the power supplies, which were located at the bottom of the rack. As all hams were wont to do, I cut a viewing window for them in the power supply front panel. The blue glow from the rectifiers made a pretty sight and always impressed visitors to the shack.

My crystal microphone was a high-impedance Brush crystal earphone unit mounted in an automotive cowl lamp housing removed from a 1927 sedan found in the local auto junk yard. To shield the crystal element, I replaced the glass lens with fine-mesh screening from a milk strainer. The antenna tuner on top of the rig was a then-new circuit called a Collins pi-network. Antenna switching between transmitter and receiver was manually accomplished via a large porcelain-based knife switch.

On December 5th 1941, the exciter chassis with the 47 oscillator and 46 buffer was removed for modification and updating. The new exciter consisted of a type 6F6G oscillator and a type 6L6G buffer. December 6th saw the completion of the new exciter ready to install in the rack.

I was at work at the studio-transmitter of station WMRN on Sunday, December 7th when the announcement of Pearl Harbor broke in the news room. Later in the evening, before station sign-off, I warmed up the station's AR-77 communications receiver to listen across the ham bands. In accordance with the FCC order issued that day, all amateur operations were to cease at midnight local time. One-by-one stations signed off the air and by midnight (EST) all was quiet with only a few Midwest (CST) stations remaining.

In 1946, W8VVS operated briefly with the "new" exciter. In the meantime, the 6L6GX finals were changed to a Taylor carbon-anode type (T-55). The receiver was updated to a Hallicrafters S-20 Sky Champion. The original 1935 vintage All-Star Senior receiver has since been restored and is on display in my small museum. Ah, those were the days!

OLD EQUIPMENT CONTEST, *continued from page 19*

tube. Perhaps the replacement of pot-metal parts by silver-gray-colored epoxy castings has been accomplished by one of us. If so, please bring in the set that incorporates that restoration. Entries should be accompanied by documentation showing how your update preserves the quality of the original.

21. NEW OR REBUILT.

Previously we have encouraged entries that showed the conference attendees how substitutions and reconstructions would provide vital parts or pieces. We also encouraged craftsmen who had made an old function come alive again to bring their work for review.

Do you remember the Federal receiver and the operating Marconi coherer detector that were entered in previous contests? We want to continue that tradition so bring in your retrospective designs and your reconstructions. There is no requirement for particular devices or circuits.

MICS AND MEN

EDITED BY **GEORGE A. FREEMAN** WITH **JANET DELL FREEMAN**, 102 E. MAIN ST., MADISON, IN 47250-3411. PHONE: (812) 265-6878. E-MAIL: RALOGEUM@AOL.COM.
PLEASE INCLUDE SASE FOR REPLY.

The Mic: Neumann U-47/U-48. The Man: Frank Sinatra

Lofty achievements and staggering adversity characterize both our featured manufacturer and our featured vocalist.

Georg Neumann (Pron: Noy'-muhn) had founded his company in Berlin in 1928 just as radio was becoming an important industry. Allied bombing in 1943 hit the Neumann plant in central Berlin with incendiary bombs. Neumann drove south of the capitol and observed that the little town of Gefell had no bomb craters. Here is where he set up a new factory, completed in 1944.

But construction of the Berlin wall, leaving the Gefell plant in East Germany, disrupted business. A new Neumann plant was built back in West Berlin. The Gefell plant became "Georg Neumann & Co." supplying microphones to Soviet Bloc countries. The Berlin plant, later sold to Sennheiser, became the Neumann division of Sennheiser.

Sinatra recording with his "Tellie."

Neumann's U-47 microphone was created in 1947. It was the first switchable-pattern condenser design. The U-47 featured a high performance World War II military VF14 tube and a dual-diaphragm M7 capsule, with essentially back-to-back cardioid capsules that could be combined to create an omni pattern or used singly for a cardioid pickup.

Distribution issues with Telefunken, marketer of Neumann products at that time, and post-war production snags delayed introduction of the U-47 until 1949. Some eight thousand were sold at $400 each. Eight years later, the U-48, a cardioid/bi-directional switchable version, was added to the line. The U-47/U-48 were used not only by Sinatra but by other famous entertainers of the 50s and 60s including the Beatles. (1)

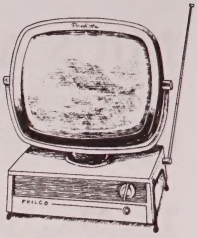
Sinatra specified his "Tellie" (for Telefunken) for use in making some of his most successful recordings. "To Frank, a microphone is as real as a girl waiting to be kissed" (1). Sinatra's personal fortune was estimated at $200 million in 1997, yet his life was often marred by self-inflicted personal problems that reduced him to a sometimes pathetic and often maligned figure. The entertainer is credited with significantly assisting in the election of President John F. Kennedy.

REFERENCE

(1) E. B. White in "The New Yorker".

TELEVISION

EDITED BY **RICHARD BREWSTER**, 145 LITTLE PECONIC BAY ROAD, CUTCHOGUE, NY 11935 *PLEASE INCLUDE SASE FOR REPLY.*



The First Really Portable TV

As I begin this column, our ship, M/V Anastasis *is sailing up the West African coast just off Dakar, Senegal. (Isn't modern technology great?) It is not a particularly smooth sail but we expect to be in Santa Cruz de Tenerife by Wednesday morning. This will be a six-day R&R for the crew of our hospital ship—which has been docked in Freetown, Sierra Leone since early November.*

I'd be pleased to hear from anyone who has an idea for a future TV column. Please contact me at Richard.Brewster@mercyships.org. I will be happy to edit as required.

The cover of the August 1959 issue of *Popular Science* magazine shows a photo of the Philco "Safari" Television and notes in large type, "First Really Portable TV." Philco was a rather innovative company as shown by their development of the "Mystery Control" wireless remote-controlled radio in 1939 and their work in the development of television in the late 30s. The Philco "Predicta" TV has been a long-time favorite with collectors.

How Much Can You Save With a Small Car? PAGE 78
POPULAR SCIENCE
AUGUST · 35c Monthly
First Really Portable TV
How It Works
How Good Is It?
PAGE 84

Newly-developed Philco Safari was featured in the August, 1959 issue of Popular Science.

Priced at $255.00, the Safari was not a cheap toy. At that time, a Chevy Impala cost less than $2000.00 and $150.00 was a good weekly wage. But the Philco was pushing the limits of solid-state technology. In fact, as noted in the Popular Science article, "....a Safari contains 60 odd dollars' worth of transistors."

The Safari is large—approximately 8 by 16 by 5 inches and weighing 15 pounds! But it provides an amazingly large picture (14 inches diagonal). This picture, a virtual image bigger than the set itself, is accomplished by the use of an exotic projection system. It's all done with mirrors: the image appears to be located four feet behind the set! It is generated by a tiny two-inch projection tube with a 10,000 volt second anode.

The *Popular Science* article explains that "The bright idea came to research v-p Dave Smith when he was flipping through that standard source of inspiration, the Sears, Roebuck catalogue. He saw Sears' slide viewer." The down side of the fancy optical system is that, in spite of the large image, only one person at a time can watch.

Philco developed many of the 21 p-n-p transistors specifically for use in this set, including the high frequency MADT (micro-alloy diffused base) types used in the tuner and the 45.75 MHz IF section. Three transistors are used in the tuner—as RF amplifier, oscillator and mixer. These are followed by an IF composed of four more MADTs.

The video amplifier, which also supplies AGC, has two stages of gain, delivering 20 volts of signal to the CRT. The audio section, after take-off from the 1st video amplifier, has two IF stages followed by a discriminator and audio amplifier. There are two transistors in the sync

(continued on page 31)

NEW BOOKS AND LITERATURE

DAVID W. KRAEUTER, P
PLEASE INCLUDE SASE FOR REPLY.

Books to be reviewed in this column should be sent directly to David Kraeuter at the address above. After review, all such books become a permanent part of The AWA Library, which is part of The AWA Electronic Communication Museum and is available to members for browsing and research.

Radios of Canada
By Lloyd Swackhammer. Published 2002 by Cober Printing Ltd., 519-638-2827, www.hammondmuseumofradio.org, 8½ x 11 inches, 164 pages, softcover, $43.00.

If the geese that often fly in ragged "V" formations above AWA's late summer playground in Henrietta, NY are Canada Geese—not Canadian geese—then by wacky analogy the radios in Swackhammer's book must be Canada radios. Whatever, this book has been needed if for no other reason than to make a start in plugging the gap in published information on this topic.

It is tempting to think of Swackhammer's book as a Canadian answer to Douglas' *Radio Manufacturers of the 1920s* for there are several obvious parallels—the 8½ by 11 format, alphabetical arrangement and use of contemporary reproductions, to name a few. But at 776 pages Douglas' work provides greater depth than this one.

The hook which keeps Swackhammer's book before us is the unfamiliarity of the contents. Ever hear of a Dominion Electrohome radio? How about a Dispro? A Pollock-Welker? Serviced any Walberts lately? Ever trade a Crosley Pup for a Spilsbury & Tindall Limited or a Penberthy Injector?

If you have serviced a Walbert, you may have used the schematic in the *Canadian Radio College of Canada* schematic books or the *Mallory Yaxley Encyclopedia*, either of which could be called the *Rider's* of Canada radios.

The two-part index to the book first lists product names, then companies and people. This book is for all Canada radio enthusiasts.

♦ ♦ ♦ ♦

A History of Television, 1942-2000
By Albert Abramson. Published 2003 by McFarland & Company, 800-253-2187, www.mcfarlandpub.com, 8½ x 11 inches, 309 pages, hardcover, $75.00.

Purists will complain that Abramson's volume is misnamed, that it should not be called a history because it "merely" tells what happened, not why. But no matter. What the book may lack in interpretation is more than compensated for by the profuse enumeration of television facts. There are many thousands of these, all carefully documented. The footnotes alone number over 1,600, and many of them include additional facts not shown in the main text.

The extensive coverage quickly reminds us that those who think of television as only the box in the living room are severely limited in their perceptions. Abramson covers every major television equipment and technology development in the past half century, including a great deal on electronic moving picture recording and playback.

In the chapter "Death of RCA, or the G.E. Massacre," Abramson flatly describes GE's dismantling of RCA's radio research center in the late 1980s as "a crime." (Lots of interpretation in *that* statement). For a kinder, gentler view of this event see the Magoun book reviewed below.

Abramson's earlier volume covers the years 1880 to 1941. Together these two books comprise a cornucopia of television facts. As such, the set is likely to be cataloged into reference collections in libraries. Librarians and researchers may be disappointed that the index to the book was not more robust. With literally dozens of facts listed on each of the 260-some main pages of text, a more detailed index was in order for this book. For example, some people important enough to have their photographs in the book are nevertheless not listed in the index.

This two-volume history of television represents an enormous amount of work accomplished essentially by one person. Compare with the following *Encyclopedia of Radio*, which was accomplished only through the labors of some 240 contributors.

Abramson's *History of Television, 1880-1941* is reviewed on page 37 of the November 1998 *OTB*. For Richard Brewster's interview of Abramson see pages 38-39 of the February 1997 *OTB*.

♦ ♦ ♦ ♦

Museum of Broadcast Communications
Encyclopedia of Radio
Edited by Christopher Sterling. Michael C.

Keith, consulting editor. Published 2003 in three volumes by Fitzroy Dearborn. Available from Routledge, 800-634-7064, www.routledge-ny.com/radio/, 8½ x 11 inches, 1,650 pages, hardcover, $375.00.

This beautiful set is enough to get this old librarian's heart racing. Think of it—1,650 pages of radio stuff! Reason demands I start by reading the editor's introduction, but I don't. Instead I flip open volume two at random and start turning pages. I notice first the two-column-per-page layout (typical for multi-volume encyclopedias), pleasing typeface and wide margins, and paper of obviously high quality. I skip through a few articles and finally settle on "Italy," the first paragraph of which tells me much I didn't know:

Italy, the country where radio was invented, is home to one of the most advanced and diversified of the world's radio systems. The distinguishing feature of Italian radio is its 3,000 different stations, a figure that places Italy second only to the United States in the total number of signals available. With an average of one radio set for each of its 60 million people, Italy has one of the world's highest levels of radio penetration. Generating more than $400 million in annual revenues, Italy's commercial radio sector is the seventh largest in the world.

General encyclopedias by definition attempt to cover all knowledge; specialized encyclopedias attempt to cover all knowledge on a particular subject. Of course, neither can. Humanity has been producing information for millennia and, recently, at such a rate that the best any encyclopedia can now do amounts to an organized summary or outline. For example, the present work is international in scope, and this presents a considerable challenge to the editors. Most of the 20 most populous nations receive comprehensive overviews, with the exceptions of Ethiopia, Egypt and Nigeria. (Iran information is indexed under "Persia"). The editor explains:

Our approach is international in scope, though with a strong emphasis on the United States and a secondary emphasis on key English-speaking nations including Britain and Canada (volumes such as these could be assembled for many other countries). Other regional entries provide at least brief comparative comment on most other systems of and approaches to radio broadcasting.

Note carefully the title: *Encyclopedia of Radio*, not *Radios*. So hardware enthusiasts may be disappointed. There are no articles about particular radios (though there is an article on receivers) and no pictures of radios. In fact, the only photos are black-and-white portraits accompanying biographical articles. There are about 200 such articles and many of our heroes are included—Armstrong, de Forest, Fessenden, Marconi, etc. A few of our non-heroes are also here—Axis Sally, John R. Brinkley (the "goat gland" doctor), Tokyo Rose, etc. Each biographical article is followed up with a summary which includes important dates and achievements, awards, and publications. Other prominent entry types are radio programs and personalities, organizations, and station histories. An extensive 44-page analytical index closes the work.

Even though it is published at the beginning of the age of electronic information, this old-fashioned paper-and-ink encyclopedia will remain a landmark in radio literature for years. Printed at substantial expense and aimed at the library market, it's way too expensive for the average radio hobbyist, though I see a copy of the set listed for $149.00 at *www.strandbooks.com* ("eight miles of books," many at half price or less). Even at that price, I suspect it won't be there long.

♦ ♦ ♦ ♦

David Sarnoff Research Center: RCA Labs to Sarnoff Corporation

By Alexander B. Magoun. (Images of America series). Published 2003 by Arcadia Publishing, 888-313-2665, sales@arcadiapublishing.com., 6½ x 9¼ inches, 128 pages, softcover, $19.99.

At first glance this appears to be a thicker-than-usual RCA promotional pamphlet, but closer inspection reveals it's much more than that. This book affirms the wisdom of a well-known saying about the value of a picture. It amounts to a brief pictorial history of RCA Laboratories (now the David Sarnoff Research Center) from its beginnings in 1941 to the present. The pictures are made even more worthy by the inclusion of insightful captions. These very often identify the persons pictured, so the book provides portraits of many lesser-known behind-the-scenes radio technologists seldom included in popular radio histories. (Too bad that a large proportion of the photos of women are unidentified.)

We have, for examples, posed photos of James Harbord (RCA chairman), Browder J. Thompson (high-frequency tubes), James Hillier (electron microscope), George Brown (rf heating), Albert Rose (image orthicon), Harry Olson (acoustics), Les Floury (infrared tube), Richard Webb (electronic color TV camera), Jan Rajchman (magnetic core memory), Elmer Engstrom (Center director), Charles Young (fax technology), and many others. Of course Zworykin makes many appearances, including taking a

(continued on page 31)

BY FRANK J. LOTITO, K3DZ

LET'S TALK OSCILLATORS

Or Why is My Hartley Squealing Like a Pig?

Let's begin our look at oscillators from a very generic point of view, Instead of discussing specific oscillator circuit designs, we'll call the oscillator "a feedback amplifier that we want to oscillate purposely and at a controlled rate." It doesn't make any difference whether the oscillator is a mechanical device, or (as we usually encounter it) a tube or solid state circuit. The oscillator's purpose is to provide a reliable periodic driving force that is used for a particular application, which may be:

- Timing for a digital circuit/computer
- Musical tones as in an audio synthesizer/ electronic organ
- Measurement or indication of time, as in a metronome or a mechanical or electrical clock
- A cardiac pacemaker
- The back and forth reciprocating mechanical action of steam engine, as used on trains
- The vertical and horizontal sweep circuits use in analog TV
- Part of a heterodyne circuit in a radio receiver's first mixer, or BFO detector stage—or even in a one tube regenerative receiver
- The RF carrier generator in transmitters, be the transmitter a simple one-tube '29 Hartley, or the "reference oscillator" in a modern digitally synthesized transceiver

The list goes on, and on, and on. Of course, there is the unintentional oscillator. "Unintentional" meaning we did not want the device to oscillate, but it did! To understand oscillators we must understand both the "intentional" and "unintentional" cases.

In a self-controlled oscillator, the frequency is determined by the circuit's component values, such as the coil and condenser in an r.f. circuit. In a crystal-controlled oscillator, the frequency is primarily controlled by a crystal, which is nothing more than a solid state equivalent of a series or parallel, exceptionally high "Q," L/C circuit. In order to oscillate, either type must have a power source and the conditions for oscillation be satisfied.

We can tie in concepts we're familiar with in electronic circuits, such as "feedback, amplification, oscillation, and power source" by using the simple mechanical pendulum, of one of the most classic oscillators of the last millennium (Figure 1). I'm sure we have all played around with this type of device for fun, out of curiosity, for academic study as in a high-school physics lab, etc.

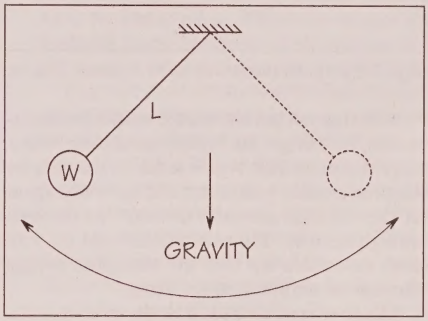


Fig. 1. The simple mechanical pendulum: a classic oscillator.

The period, or time for one complete back-and-forth-cycle, is given in beginner's level physics textbooks (1) as:

$$T = 2\pi(L/g)^{1/2}$$

Or in terms of, frequency which is more familiar to radio and communications buffs:

$$f = 1 / [2\pi(L/g)^{1/2}]$$

where: L = the length of the string
g = the gravitational constant
f = the frequency, which is simply the reciprocal of time. (For example, if the period is ¼ second, the frequency is 4 Hz, or 240 beats per minute.)

Doesn't this formula look strangely like the

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electronic frequency formula you may have learned?

$$f = 1 / [2\pi(LC)^{1/2}]$$

How does the pendulum oscillator get started, where's the power source? Amplifier? Feedback? In Figure 2 we have a complete pendulum oscillator system, which includes a human being taking the part of a "hand-operated amplifier-eye-brain coordinated feedback device."

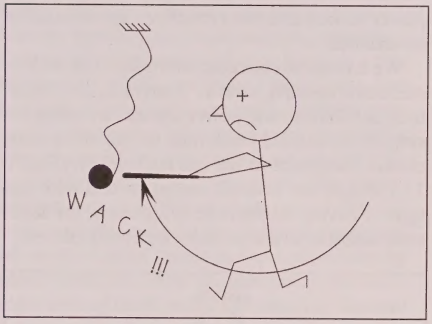

Fig. 2. Every oscillator requires a power source.

If the human has reasonable hand-eye coordination, he can get the system oscillating with a slight tap to the ball. Again at the correct time he supplies another gentile tap, and again and again at the "correct moment in time" as the ball swings his way. The oscillations build up with each successive tap until the pendulum swings through an amplitude to his liking.

I think we can now see how the system starts, where the power is coming from, and how the feedback occurs. Rig up a pendulum and show your toddler-aged child or grandchild how it can be made to swing. Give the child the tapper, and before the child takes the first swing you have no trouble imagining the outcome when feedback and power are uncontrolled!

Here are the points to be made with the pendulum and toddler example, which also apply to other mechanical or electronic forms of an oscillator, intentional and unintentional:

- Feedback requires feeding energy back in the correct phase (at the correct time).
- The feedback energy has to be powerful enough to makeup for the swing to swing losses, but not so strong as to cause the pendulum to go into other modes of oscillation.

Additional points: "Tuning" makes the oscillator oscillate near the frequency we want. In the pendulum, the "tuned circuit" is the string and bob. Do we have to tap on every swing? No, every second, third, forth, etc. swing is good enough. How hard to we have to tap? For a very dense round smooth ball on a string loaded by only aerodynamic friction, not very hard.

We notice two things if the string is replaced with a wide strip of metal that is orientated broadside to "catch the wind." First, the pendulum's period is longer (frequency decreases). Second, we have to tap harder to maintain the same "peak-to-peak" swing amplitude. No doubt "loading" requires a higher energy input to get the system going and to keep it going.

Back to electronics. Figure 3 illustrates two generalized examples of feedback amplifiers. Voltage feedback is shown in the left drawing. The feedback circuit is connected across the amplifier's output. Current feedback in is shown in the right drawing. The feedback circuit is connected in series with the amplifier's output. Think of how a VOM is connected. To measure voltage we connect "across" the device, to measure current, we connect in series with the device.

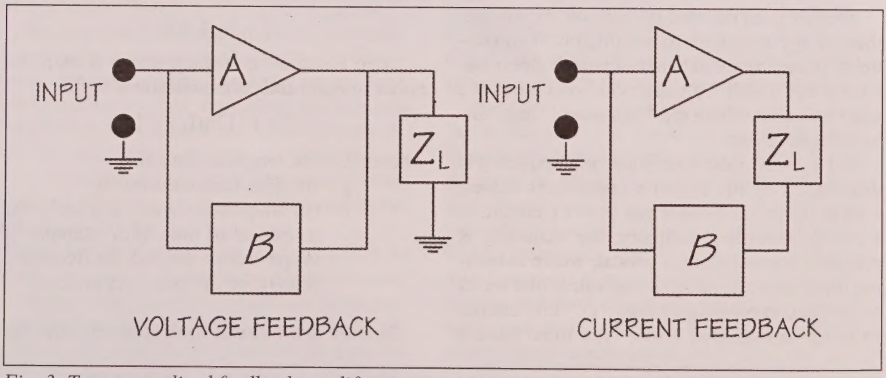

Fig. 3. Two generalized feedback amplifiers — see text.

The diagrams of Figure 3 represent:

- An amplifier with an open loop gain of A
- A feedback circuit with a transfer constant[1] of *B*
- A load on the amplifier of Z_L. For electronic oscillators the load is generally "tuned" to the frequency we want.

The gain of the generalized feedback amplifier is given by:

$$A_{fb} = A / (1-AB)$$

The terms A, A_{fb}, *B* and Z_L are vectors (2). They have resistive and possibly reactive components.

A few salient items are embedded in above equation:

- If A*B* is real, positive and less than unity, the feedback amplifier's gain is larger than the amplifier's open loop gain. We call this regeneration.
- If A*B* is real and negative, the feedback amplifier's gain is smaller than the amplifier's open loop gain. We call this degeneration.

Most definitely, regeneration can mean "oscillation," but only if the terms A and *B* are correct for the circuit.[2]

If we have a generalized amplifier where the feedback is regenerative and the conditions for oscillation are present, the following happens when power is suddenly applied:

- The amplifying device's transconductance is usually near maximum, thus the gain is high.
- Self generated noise is high and quite broadband.
- A starting shock is introduced in the load and feedback system.

Circulating through the amplifier-feedback loop is a noisy broadband signal that starts to represent the oscillation frequency we want. The circulation occurs because part of the output is routed through the feedback circuit to the amplifier's input. Circulation continues, the desired signal keeps building up, and the circuit tuning helps to narrow and limit the broadband noise. Eventually the oscillator saturates, that is it runs out of dynamic range, and the oscillation amplitude levels off at a constant value.

While all this is happening, the "bandwidth" of the feedback amplifier circuit can narrow to a fraction of one Hertz. In some oscillator designs the oscillatory signal becomes reasonably sinusoidal. In others, the oscillatory signal may be quite non-sinusoidal, i.e., loaded with harmonics that are exact multiples of the oscillatory frequency we want. There still is noise, but it's effective bandwidth and power has been significantly reduced.

Feedback might not be limited to a single path. In a multiple stage system, there can be numerous feedback paths within a particular stage and between the stages. These feedback paths can be degenerative, or regenerative, voltage feed, or current feed. The feedback signal, whether degenerative or regenerative need not be a sinusoid, as is in a simple oscillator.

The feedback can be a signal representing an attribute of the system we want to control, i.e., a heavily filtered DC level representing the amplitude of a detected signal. Multiple feedback paths can be found in many devices, for example a TV set. Besides audio stage degenerative feedback to improve audio frequency response, there are power supply regulation circuits, AGC and AFC feedback paths. Problems within these feedback loops can cause whole sections of the TV receiver to go into uncontrolled oscillation.

That's all there is? No way! I skipped over a lot of oscillator-related academic theory and practical applied technology. First, a practical real electronic circuit has, here and there, a lot of stray capacitance, inductance, as well as electrostatic, and/or electromagnetic coupling here and there.

A not-uncommon example is an amplifier amateurishly put together with "rats nest" wiring. This creates unintended multiple feedback paths that definitely invite troubles. The builder who wanted an amplifier, with degeneration might instead wind up with a ratty-sounding oscillator.

Why? Examining a circuit model with as many strays as we can account for, we find out that at some frequencies, namely the lower ones, the model looks like the actual schematic diagram of the amplifier. As frequency increases, the strays start to increase in importance, and some of the components might stop behaving ideally. For example, the shunt bypass foil capacitor might begin to look like an inductor. So might the longer leads. Worse yet, those might start to look like single-turn coupling transformers!

Another possible cause for undesired oscillation is the choice of an amplifying device with excessive open-loop gain. We may have been over-generous in choosing the amplifying device. For example, we might have used a UHF oscillator triode when all we needed was a simple low-frequency triode like a #45 half of a 6FM7.

Insufficient conductive isolation is another reason for unintended oscillation. For example,

conductive feedback on the B+ or filament lines. Inadequate B+ line decoupling can cause "motor boating," a regenerative oscillatory condition in audio amplifiers with multiple stages. Decoupling circuits might employ series resistors or chokes in combination with bypass capacitors.

Undesired oscillation can be caused by mechanical instability—otherwise known as microphonics. Microphonics can be found in circuits not intended to be oscillators as well as circuits intended to be oscillators. Microphonic oscillations are undesired audio-rate oscillations often caused by electromagnetic induction effects, mechanical shock/vibration, or audio coupling that excites mechanical resonance in one or more component parts.

Here are a few examples: the first two involve damped oscillations; the last an undamped (continuous) oscillation:

- Fire up your '29 QSO Party transmitter. Now lightly drag a long skinny wood dowel across the tank coil, then across the main tuning capacitor. As you do this, listen to the transmitter's note in a well-shielded monitor receiver. Very likely you will hear a damped ding-ding-ding ringing of the dowel as it skips up and down over the coil turns and capacitor plates.
- Using the same dowel and monitor receiver, lightly tap the tube's envelope. Again you will very likely hear a ringing tap-tap-tap—possibly with a broad tonal characteristic.
- A modern example: Recently I built the Ramsey FX-440 synthesized 70 cm NBFM transceiver kit. Instead of purchasing the optional case, I built my own using 0.016"-thick 6061-T6 tempered aluminum sheets for the top and bottom. The sides, front and rear of my case were ¼"-thick × 1¾"-wide aluminum bar stock. I used an externally mounted 3×5 speaker in a home made wooden enclosure. Mistake! If I located the speaker too close to the FM receiver, I got a terrible howling out of the speaker when the squelch was broken.

It turned out the speaker mechanically excited the thin tempered aluminum top and bottom case covers. This vibration was acoustically coupled to the VCO[3], which then FMed the synthesizer! I also suspected that capacitive coupling of the VCO and top and bottom covers added to the FMing! The VCO was quite shock sensitive! On transmit the VCO's mechanical sensitivity imparted a noticeable low-level broadband hum to the audio.

Finally, let's consider parasitic oscillations. These undesired effects could be transitory or continuous and their frequency might be either above or below the circuit's operating frequency. A parasitic oscillation is caused by an unintended "gain-feedback path" condition that allows the stage or system to oscillate intermittently or continuously.

For example, some key and modulation clicks are transitory (damped) parasitic oscillations. One mechanical example of a transitory parasitic is an older car with a worn out front end. Hit a bump, the front end shakes (vibrates), then quiets down until the next bump. Even LC and crystal tuned oscillators can have parasitic oscillations! Amplifier neutralization, the use of parasitic suppressors in amplifiers and oscillators, parts selection[4] and layout, shielding, and/or electronic design can eliminate parasitic oscillation.

Since oscillation generally involves one or more non-linear circuits, the parasitic can heterodyne (mix) with the intended operating frequency. This produces dozens of sum and difference frequency sets. These frequency sets may cause significant out-of-band signals to be radiated by the antenna system, and/or cause excessive interference to adjacent channels in the same band.

We can even say that excessive coupling (over coupled state) in an oscillator, including an OT '29 QSO Party one-tuber or MOPA, is a type of parasitic oscillation. With over coupling there are two nearby gain-feedback routes that support oscillation, and they definitely will mix and remix in the oscillator stage causing an undesired broadening of the OT transmitters emission!

So carefully choose your components and electrical design, be careful of your mechanical layout and mechanical design, and provide isolation between circuits. This helps assure that non-oscillatory circuits stay non-oscillatory, and oscillatory circuits oscillate only at the frequency you want! However, as bleak as this article may have colored the subject, amateurs and electronic experimenters don't have to be rocket scientists to enjoy the hobby of home brewing! It's not that difficult to understand basic oscillators, and to keep non-oscillators from oscillating! Have fun, and be safe.

1 Transfer constant is the relationship between a circuit's output and input. A simple example might be two identical pure resistors in series. If the input is the voltage applied across the two resistors and the output is taken across one resistor, the transfer constant, or relationship of the output to the input voltage is ½.

2 Positive, or regenerative, feedback does not

necessarily mean oscillation. Two examples: a regenerative receiver operated just below the point of oscillation of the detector stage, or a "Q" multiplier stage designed into/added to the IF section of receivers in the 60 to 70s era (3).

[3] A VCO is a voltage controlled oscillator. For example, one type uses back-biased diode in a crystal or LC oscillator circuit. The back bias controls the diode's capacitance and the diode's capacitance forms part of the oscillator's tuning circuit..

[4] A classic example of a parasitic oscillation related to parts selection is TPTG oscillation in an RF stage when identical RF decoupling chokes and bypass capacitors are used in a stage's grid and plate circuits.

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(1) *College Physics*, by F. W. Sears and M. W. Zemansky, 3rd edition, 1960, published by Addison-Wesley Publishing Co., Inc., Reading, MA, Section 11-5, page 228

(2) *Applied Electronics*, by T. S. Gray, 2nd edition, 7th printing, April 1959, published by John Wiley & Sons, NY, Chapters IX, pages 570-600, and XI, pages 657-685. (Note, similar analysis is used for solid state versions of the tube oscillators presented in this chapter.)

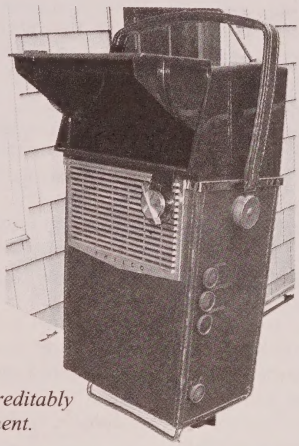
(3) *The Radio Amateur's Handbook, 41st Edition*, 1964, published by the ARRL, Newington, CT, pages 107-108 and 140-141 (and other editions around this time)

TELEVISION, *continued from page 24*

separator circuit.

The vertical sweep has only two transistors, oscillator and output. The horizontal is somewhat more elaborate, with an oscillator, buffer and output. The set does have two vacuum tubes (besides the CRT) in a voltage doubler HV circuit, producing the 10,000 volts needed for the 2EP4 CRT.

A 7½-volt rechargeable battery supplied power for about four hours. It was a newly developed alkaline type and it could only be recharged about 20 times. Of course, the set can be operated on 120 volts. I was pleased to discover that the design uses an isolation transformer and a fuse in the secondary.



The author's Safari performs creditably even in a weak-signal environment.

Controls on the set are: on-off volume, contrast, range (sensitivity), horizontal hold, vertical hold, and brightness. My Safari works just great in a rather weak signal environment. It was operational when acquired. I have not operated it on battery power.

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BOOKS, *continued from page 26*

bulldozer ride at the Research Center with Irving Wolff at the "steering wheel."

Thanks to Magoun for getting these photos all in one place and identifying so many of the RCA research pioneers.

♦ ♦ ♦ ♦

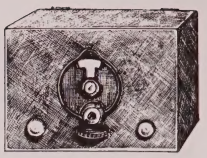
AWA Tube Collector Group FACT SHEET, Volumes 1-6

Published 2004 as Tube Collectors Association Special Publication No. 7. *TCA Inc., P.O. Box 1181, Medford, OR 97501, www.tubecollectors.org, 541-855-5207, 5½ x 8½ inches, 62 pages, softcover. $18 for the package, which also includes copies of all TCA publications for 2003. May also be ordered from tca@jkasystems.com using PayPal.*

The introduction states: "The AWA Tube Collector Group was a subgroup of the Antique Wireless Association(TM) specializing in the history and collecting of tubes. Organized and conducted by Lauren Peckham, it formally existed between 1976 and 1981. It presented tube-related sessions at the annual AWA conference at Canandaigua, NY and produced a regular newsletter, the *Fact Sheet*.

"This booklet reproduces the content of the 21 quarterly issues of the *Fact Sheet*. The latter contained historical material that has appeared nowhere else, so it should be of interest to today's collector-historian."

For anyone whose interests lie with the "tubic" (to use a word recently coined by the TCA editor).



Linc Cundall OT CW Contest

The 2004 Linc Cundall Memorial OT CW Contest was held on the last week of January, extending into February 1. Following last year's standards, equipment up through 1946 qualified as "old time." At the suggestion of a number of our AWA members, a major change was made in the time and scoring for activity in the 160 meter band. Contacts were limited to the first period (Jan. 28-Jan. 29). In addition, scoring for 160 meter contacts was increased to 3 points for E to E or W to W. The remainder of the scoring rules applied as usual.

This change was made in hopes of increasing activity in the 160 meter band. Apparently it did help. There were 19 QSOs on 160 meters this year as compared with just 2 QSOs the previous year. I hope the trend will continue to improve.

Overall activity in the Linc Cundall OT Contest continues to slowly decline, with 43 logs returned as compared to 52 last year. Some of our long-time stalwarts were missing for one reason or another. Even W2AN, our star station at AWA headquarters was absent this year!

On to good news. We have a real winner in this year's event. Steve, KJ8L, swept the field with an astounding score of 615 points — WOW! Heartiest congratulations to Steve. One of the AWA participants commented that "Steve was everywhere, all the time!" It is interesting to note that his 160 meter score of 135 points was garnered with just 5 QSOs. His pre '46 equipment for both TX and RX and 24-watt power helped boost the score.

Bill, W3HWT, also helped his overall score by 109 points with 4 QSOs on 160 meters, and by operating early equipment under 24 watts (1932 TX, 1921 RX). Guess I shall have to put together something for 160 meters next year. Hi. Steve used a WWII Navy TCS rig throughout the contest. Parke, W1YG, was a strong second and Frank, K3DZ, was in third place.

Conditions for the contest seemed to be fairly good in most areas across the country.There was only one station active in the 9th District and only one operator in the 5th District where Dick, K5RB, held forth as usual. Jim, W8KGI, in New Mexico seemed to have favorable conditions this year with 18 QSOs total. Activity on the west coast was sparse.

Our DX member Sven, SM4DIG, was on 20 meters and 40 meters but only two contacts were made on 20 and only one on 40 meters. Parker, W1YG, reported that Sven was very strong, a "true S-9" signal, but he could not raise him with his "peanut whistle." Hopefully more of us can work Sven in the future.

Well that about wraps it up for another year. Many thanks for your notes and photos. Hope to see you next year.

73

John F. Rollins, W1FPZ

TOP TEN SCORES

CALL	POINTS	CALL	POINTS
KJ8L	615	KB2PLW	258
W1YG	456	W2VDX	243
K3DZ	375	K1FI	237
W0NYQ	288	W3HWT	234
W1TSP	273	KB0ROB	228

TOTAL QSOs BY BAND

BAND	160	80	40	20
TOTAL QSOS	9	417	138	35

COMPLETE CONTEST RESULTS

CALL	TX	QSOs/Band 160	80	40	20	Total Points
W-1						
NE1S	'43 EXCITER GRAMMER		12	6	1	100
W1DDW	'43 BC696	2	10			76
W1TSP	'43 BC459A & BC696A		23	4	1	273
W1YT	'31 PP 46s			3	5	45
K1FI	'46 COLLINS		12	6	4	237
W1YG	'38 MEISSNER SIG. SHIF.	3	28	11		456
NV1X	MOD			6		20
W1FPZ	'29 COLPITTS		14			135
AJ1G	'43 T19/ARC-5,TCS-12		10	2		72
W1GIG	'39 MEIS SS, 29 TPTG		2			18
W-2						
W2CQH	MOD			4	3	30
N2VO	MOD		11			22
KB2PLW	'40 6L6 XTAL,'37 PR 809s	2	17	12		258
W2VDX	'39 ECO TO 807	2	14	6	1	243
W2AO	'38 6L6 XTAL		21			207
KB2E	'36 6L6 XTAL		8			66
K2KK	'37 XTAL 6L6			7		30
W2RS	'41 M.SIG. SHFTR		8	14		207
K2LP	'39 ECO TO 860		27			81
KE2O	MOD		13	5		34
W-3						
K3DZ	PP 42 XTAL, 6K6 XTAL	1	18	9		375
W3VVS	MOD		8	3		22
WB3HLH	'41 XTAL		8	3		99
W3HWT	'32 46s OSC, BUF, AMP 26 210 HART.	4	11			234
W-4						
W4VBX	MOD		2			6
K4LJH	MOD		9			27
AA4RM	'43 TCS-13		5			54
W-5						
K5RB	'39 6L6-809		1	1	3	20
W-6						
W6ZZ	MOD		5		1	16
W6TDP	210 TNT, UTAH UAT-1		2	1	1	30
W-7						
W7LNG	'43 T18/ARC 5, MOD	1	2		2	32
W-8						
W8ZNX	'41 QSL 25		13			135
WD80FB	MOD		1			4
KJ8L	'39 WWII NAVY TCS	5	31	11	6	615
KC8DDH	'29 210 HARTLEY		1			6
W-9						
W9POC	'40 6L6-807		4	6		78
W-0						
WONYQ	'42 M.SIG. SHFTR		11	4	5	288
KBOROB	'29 HART, '36 MOPA		17	4		228
WOVLZ	'39 6J5-6L6		2	1		36
VE						
VE3DKW	'44 COMMAND TXs		12	1		109
VA3AWA	'42 6L6 XTAL		16			96
VA3HN	MOD		8	7		72
DX						
SM4DIG	MOD			1	2	27

Results of the 2004 "30s Night" Get-Together

Like last year, this contest was organized by Randy Haus, KB2PLW, who also coordinates the Linc Cundall Memorial OT DX Contest, and Marc Ellis, N9EWJ, Editor of *The OTB*. Randy is responsible for setting up the frequencies, scoring, and other operating parameters; Marc, who is an inactive ham just now, with shack and antennas still under construction, collects and tabulates the logs. Randy was able only to listen this year because his newly-constructed '30s modulator unaccountably refused to utter a peep—Murphy's Law kicking in at the last moment. He did monitor a couple of QSOs.

Only seven logs came in this year, down from last year's 21. However, remember that last year's contest allowed c.w. operating, while this year the contest was a.m. only. The aim was to simplify contest operations and encourage the building and acquisition of '30s a.m. gear. So though we did narrow the playing field, we hope that—over time—more folks will become interested in this mode and era. Editor Ellis hopes some of the participants will consider writing up their equipment for *The OTB*. While there have been many articles about '20s equipment over the years, the '30s has been neglected of late.

The logs show that not as many people sent in their reports as were actually on the air. This is partly because the mailing deadline was erroneously published as May 1 (April first was intended). Any logs that come in later will be mentioned in the July "Amateur Radio" column.

Although operations were allowed on 75, 40, and 20, all participants remained exclusively on 75—except W2LID, who reported two 20-meter contacts. Those at the other end of the 20-meter QSOs have not sent in logs yet. Several people reported difficulty with SSB QRM on 75. One of them was Bob, W2VDX, who nevertheless was pleased to report nine more contacts than last year (He made nine contacts this year—you do the math!). He plans to be back in 2005.

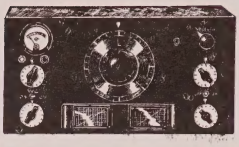
Dan, W2LID found that 40 meters was NG, said "a.m. is fun but sure uses bandwidth! s.s.b. signals seem much more readable under weak signal or noisy condx." Larry, NE1S, reported eight QSOs besides the five stations he could hear but not work. K2KK reported that he heard three stations in addition to the one he was able to work.

We hope you are all back next year for another crack at vintage a.m. In the meantime, let one of us know if you have ideas for improving this get-together. Marc Ellis, N9EWJ, mfellis@alum.mit.edu, P.O. Box 1306, Evanston, IL 60204-1306. Randy Haus, KB2PLW, rwhaus@fltg.net, P.O. Box 665, 303 Pennsylvania Ave., Trumansburg, NY 14886.

30s Night Participants and Scores

CALL	TX	RX	POINTS	CONTACTS
W1GIG	RCA ACT-150	HRO M	48	6
NE1S	37 *QST* exciter, grid mod.	39 National NC-100XA	72	8
W2DGB	39 National NTX30 with Nat. NSM modulator, 39 Meissner S.S.	36 National 101X	?	5
K2KK	MOD (55 Johnson Ranger)	(60 Halli. SX-117)	2	1
W2LID	MOD (Kenwood Xceiver)	MOD	16	6
KZRY	203AMOD with PP 809s	30s HRO	9	3
W2VDX	39 Replica	MOD (HQ129X)	54	9
K4LJH	MOD (46 Wilcox 250TL)	39 National HRO	10	5
W3VVS	Mod (Viking Ranger II)	38 RME 69	12	3

THE COMMUNICATIONS RECEIVER



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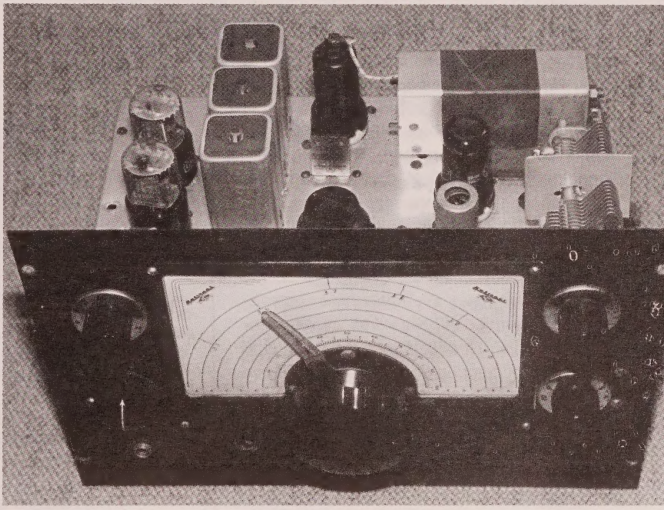
PLEASE INCLUDE SASE FOR REPLY.

A *QST* Two-Band Five-Tube Superheterodyne

In 1953 I became enamored with a cute little four-tube superhet receiver designed by Byron "By" Goodman, W1DX, one of the technical editors on the ARRL staff. Goodman was a long-time amateur with experience going back well before WW II. He presented this receiver in the January, 1953 issue of *QST*, with some revisions a year later. It was subsequently included as a construction project in every issue of ARRL's *The Radio Amateurs's Handbook* from 1953 through 1959.

The receiver is essentially a two-band, double-conversion set with a fixed regenerative second detector, no AVC, and provisions for headphones only. The intermediate frequencies are 1700 kHz and 100 kHz, with the front end arranged so that both the 80 and 40-meter bands are covered by simply swinging the input condenser. The oscillator tunes from 5.2 to 5.7 MHz, with no bandswitching. The higher-frequency bands can be covered by crystal-controlled converters, feeding into the antenna circuit. All in all, a relatively simple design that promised superior performance.



Front view of Goodman's five-tube superhet.

Incidentally, this front-end circuit design was used for a number of years in various receivers and converters in the *ARRL Handbook*. In 1960, for example, the *Handbook* presented the "2x4+1 Superheterodyne," with the same design approach but with more modern components and more features. Look it up.

Back then I didn't have shop facilities, parts, or the time to indulge myself in building it, so I went back to the dependable S-40 and waited for another day. It came, some 50 years later, when I looked inside the lid of a small black cabinet at the AWA's Annual Conference flea market. There was the very same receiver, accurately reproduced from the construction articles. The price was reasonable and it was mine.

Recently I ran across the little orphan in my shop and decided it would make a good subject for this column. A literature search revealed that Goodman had found a significant error in the original *QST* schematic and made a correction in the March issue. Then, in the December issue, he presented a circuit change. A separate oscillator tube was added and the first mixer changed to a 6AC7. From then on the good four-tube superhet became a good five-tube superhet, with better performance.

A further change was presented in the May, 1954 *QST* in response to reports of problems with obtaining the Millen 1700 kHz IF transformer. He switched to Carron Wavetrap coils, constructing his own 1700 kHz transformer. Later still (1956 *Handbook*) he modified this approach to use the then standard "Loopsticks,"

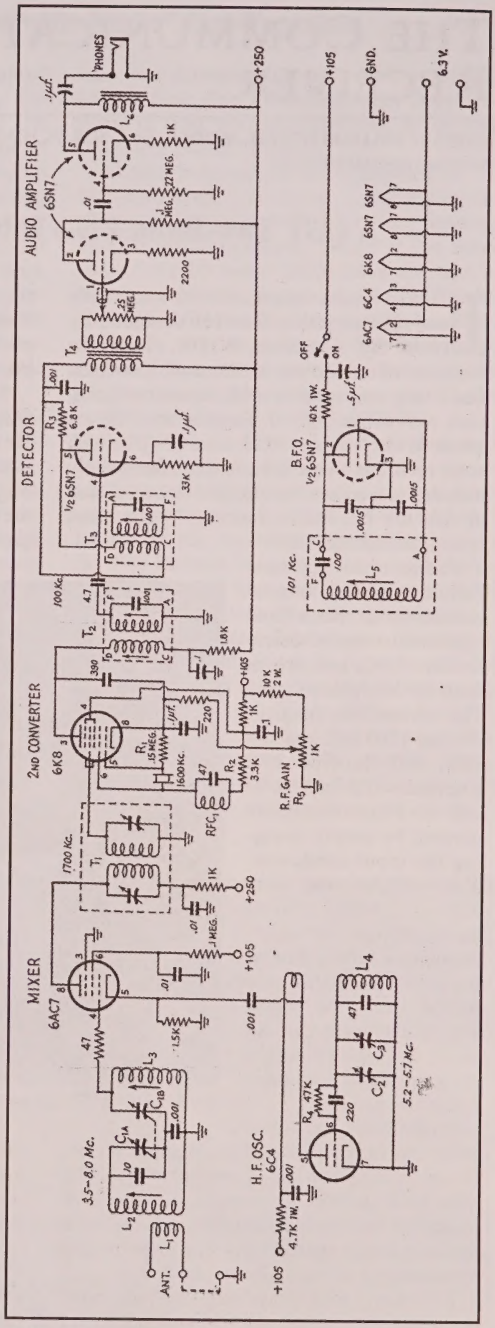
mounting them directly on the chassis about 1" apart.

This little radio had been faithfully reproduced by the builder and that it looks almost identical to the *QST* photos. However, close inspection of the wiring and other components revealed considerable rusting of the ferrous parts, to the point where a number of hardware items had to be replaced. Some wiring looked dried out, and it was decided to replace that. But before the project was done, I had rewired the whole set. (See my "A Structured Approach to Fixing Up Those Nice Old Radios" column in this issue.) Actually, the rewiring was not all that difficult, given the basic simplicity of the circuit and the fact that the original builder had used the specified parts. And after all, he had done all the hard work in obtaining the parts and doing the sheet metal work.

Does it work? Yes, it does, but not as well as I would hope. It receives AM, SSB, and CW signals in the 80 and 40-meter bands. While the front end is relatively stable, the input-capacitor tuning is quite critical, and the sensitivity is not what I had been led to believe it could be. The builder had substituted a coax fitting for the antenna connection, implying that a 50-ohm line would work; it does, but not as well as a matched higher-impedance input. Also, the 100-kHz IF adjustments appear to be critical. On the plus side, dial readings are easily reproduced, the BFO works well, and the high-frequency oscillator tunes nicely.

Reproducing this little set today would be an exercise in flea-market purchasing skill with a bit of luck thrown in. While the two chassis can be bent up by any good sheet metal shop, the crystal would be available from almost any good supplier, and the tubes can still be had, most of the rest of the parts belong to the age of home-brew, when radio parts stores were still around. Obviously some substitutions can be made; for example, the specified 100-kHz television coils could be replaced by other 100-kHz tuned circuits, and the oscillator coil by something other than a Miniductor.

More tinkering is indicated and if anyone decides to get involved with this little set, I would appreciate very much hearing about it. Just possibly, one of our readers has actually built this radio in the past, perhaps this very one! And, wonder of wonders, perhaps he will come forth and tell me his story.



Circuit diagram of the receiver as published in QST *for December, 1953. Note unusual features such as the double-tuned input circuit.*

EDITED BY **LUDWELL A. SIBLEY**, 102 MCDONOUGH RD., GOLD HILL, OR 97525-9626

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Visiting a Tube Collection

There is a wide gap philosophically, and in terms of labor invested, between "having a lot of tubes" and having an appealing display of tubes. This column hasn't said much about actual tube collections, so it's time to show off an example of a well organized display. The case in point is the collection of Robert Deuel, K2GLO ("the callsign says it all") in his home in Ashland, Oregon.

Bob has been collecting tubes since the third grade (!), when he traded his uncle a '20s cone speaker for a Western Electric 212D. Some years later, he has about 1000 tube types, nicely organized and accessible on shelves.

The collection naturally features mostly "gridded" tubes, but includes design variants like iconoscopes, thyratrons, klystrons, scan-converters, TWTs, X-ray, and other special-purpose types. There are even oldie light bulbs and vacuum lightning protectors.

Bob Deuel with his WE212D from grade-school days.

Reflecting the improved availability of foreign tubes in recent years, there is a good variety of German, British, Japanese, and even ex-Soviet tubes. The time span is rather complete, starting with a century-old X-ray tube, running through spherical and tubular Audions up into modern Svetlana-vintage tubes.

Deuel got his first audion, a CF-187, while in college. The founder of the Schulmerich electronic-carillon company in Pennsylvania had advertised a few of them for sale. He reported that there had been a small museum in the offices of the Atwater Kent Manufacturing Co. in Philadelphia, which had yielded five boxed spherical audions when the AK company was liquidated in the mid-'30s.

The photos show some novel techniques for displaying tubes. Bob has standardized on square wood blocks with sloping walls as bases for transmitting tubes. These can be mass-produced on a table saw, then stained and varnished. They can be drilled with a standard-sized hole to take the pins on "fifty-watter" tube bases, or custom-drilled to handle unusual pin configurations.

Compared to using regular ceramic sockets, they display more of the tube base. Better yet, the sloping sides are outfitted with commercial postage-stamp display holders with computer-made identification cards. The result looks quite professional. For receiving tubes, PVC piping adapters (½"-to-1") have proven to be good holders. The adapters are sawn off just tall enough to accept the tube pins.

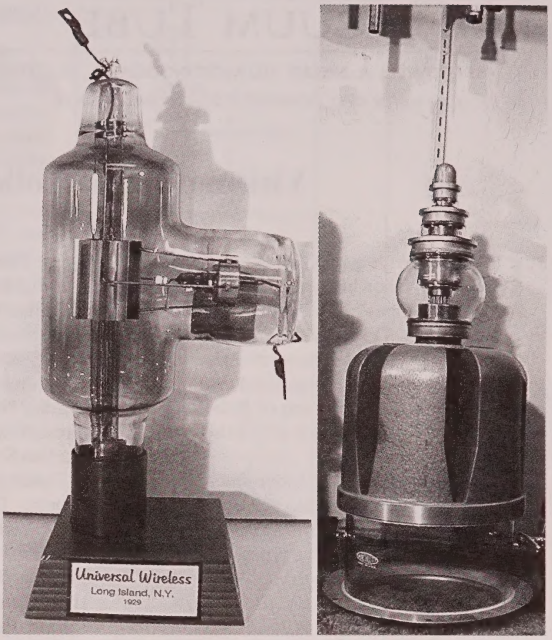
One restoration hint that may save a display tube: the collection includes a burly Machlett air-cooled power triode, of the style that has a flared glass envelope. The tube, as found, had a smashed bulb. No great problem: a flared bulb for a kerosene railroad lantern, ordered as a replacement part via the Web, is a dead ringer for the broken bulb. Only under close inspection is the replacement detectable.

The collection features a rich assortment of rare tubes, like a Pickard "golden audion," an Electrad diode, a "Le Radion" triode, and a

Heintz & Kaufman gridless-Gammatron receiving tube. The '30s receiving tubes include the RCA "original nine" steel-stamped metal tubes, a long line of MG and other glass-in-metal types, and a broad range of Arcturus blues.

The transmitting tubes include long runs of variant glass types from the "famous names:" Amperex, Eimac, Heintz & Kaufman, Machlett, Taylor, United, and Western Electric. The bigger tubes include a good range of water-cooled tubes and their forced-air-cooled versions, including an RCA 5671 triode rated at 20 kW and 130 pounds.

Deuel also collects early transistors. One display board features Western Electric point-contact devices. It starts with the Bell Labs Type A of 1948 (they don't come any earlier than that!), includes developmental types (1698, 1760, 1768, etc.), and goes into production units like the 2N21A. Another board, assembled for last year's 50th anniversary of the CK722, celebrates a wide line of Raytheon transistors that led to, and followed after, this fondly remembered unit.

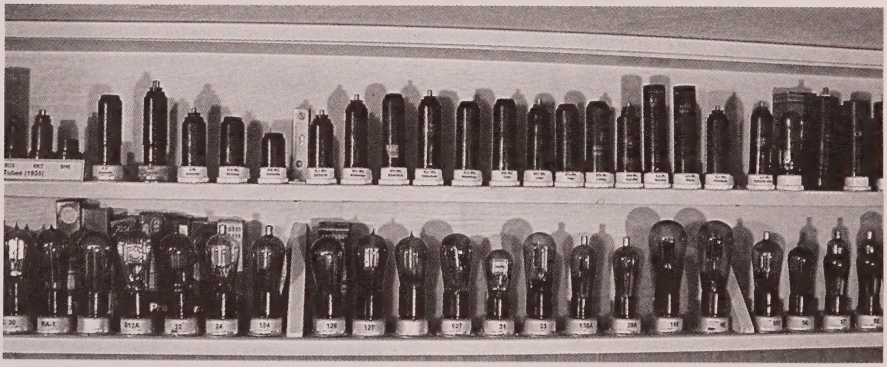


Left: A typical wood base and card holder, here with an unusual Universal Wireless transmitting triode. Right: The Machlett power tube with its kerosene-lantern bulb.

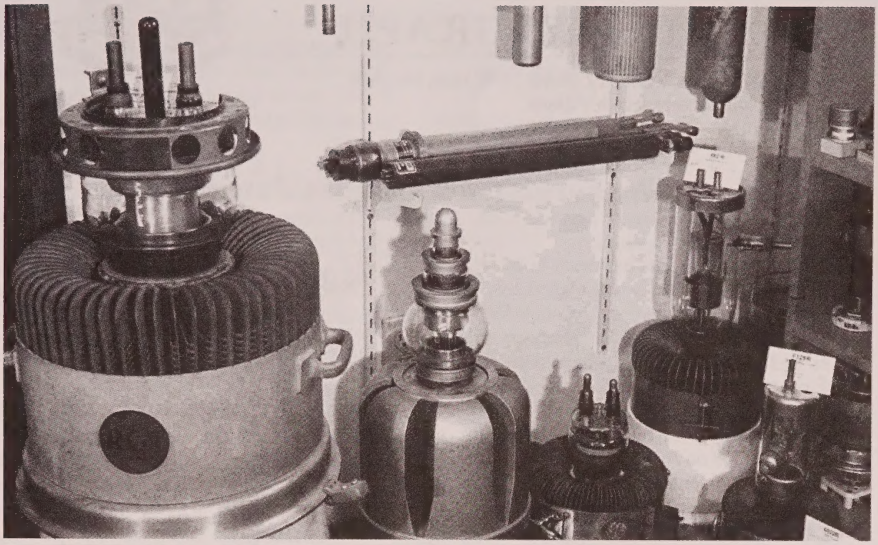
Since a transistor display tends to be a flat-panel affair, it is easy to add some creative showmanship in terms of photos of early devices, company logos, etc. This can add a lot of visual impact to what would otherwise be a simple display of devices.

Some hints on mounting transistors may be helpful. For board-mounting of devices in their original packing, it is convenient to put the package in a small plastic envelope and attach it to the backboard in any convenient way. This avoids gumming-up a fragile package.

With any luck, an initial transistor collection will grow, making it hard to insert a new type into a hard-mounted display. The solution is to use a magnetic backboard, and to mount the transistors on thin strips of flexible magnetic material as sold by hobby stores. It then becomes easy to rearrange the display. The backboard need not



Metal-glass and Arcturus blue tubes.



Typical water-cooled and forced-air-cooled transmitting tubes.

be of steel: Deuel has gotten good results by painting several coats of iron-bearing magnetic paint onto a wood panel, and finishing with an over-coat of white.

The collection has expanded to occupy most of the wall area of two rooms. One good way to use precious space has been to build some of the tube shelves in the form of cabinets. Removable front doors of acrylic plastic then keep dust off the tubes and—Californians, take note—offer earthquake protection.

This sort of thoughtfully-displayed collection takes a lot of work, but the results are insightful and enjoyable.

More on CRTs

Last August's column gave a long table of oscilloscopes and the cathode-ray tubes that they used. Our sharp-eyed reader Charles Kirsten noticed a few irregularities in the table, and pointed out a little-known but important prewar book on 'scopes. The book is *The Cathode-Ray Oscilloscope* by Charles Sicuranza, published in 1938 by Hugo Gernsback's Radcraft Publications. It seems to have been a precursor of the massive '50s *Encyclopedia* from John F. Rider.

Looking this material over and doing some checking, here are some new and corrected entries for August's table, in terms of a 'scope and the tube(s) that it used.

- RCA TMV-122B906
- Simpson 4803KP1
- Simpson 4585UP1
- Simpson 4667VP1
- Solartron CD-711S.24EP7
- Supreme 53024XH
- Supreme 53524XH
- Supreme 546906
- Supreme 546-A34XH, 3AP1, or 5CP1
- Supreme 560-A906
- Supreme 6503AP1 or 5CP1
- Supreme 655906, 3AP1, or 5CP1
- Supreme 660906

One can see how the CRT used in some of these instruments evolved with time—"a 906 is a 3AP1 with cachet."

Our thanks to Mr. Kirsten for his input!

Your AW-220 is needed

The Historical Electronics Museum outside Baltimore-Washington International Airport, famed for its displays of historic Westinghouse radar equipment, is setting up a display of tubes that led up to the WL-530 power triode. This was the transmitter tube in the pioneering SCR-270/271 radars. They would really, really like to borrow or otherwise obtain an AW-220, the six-foot triode that starred, ca. 1930, in an experimental super-power transmitter at KDKA.

If one of these monsters has survived in the hands of a reader, Robert Dwight, museum founder, would be delighted to discuss it. He can be reached at *radarmus@starpower.net*, ATTN Robert Dwight.

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The Forgotten Vibroplex Patent

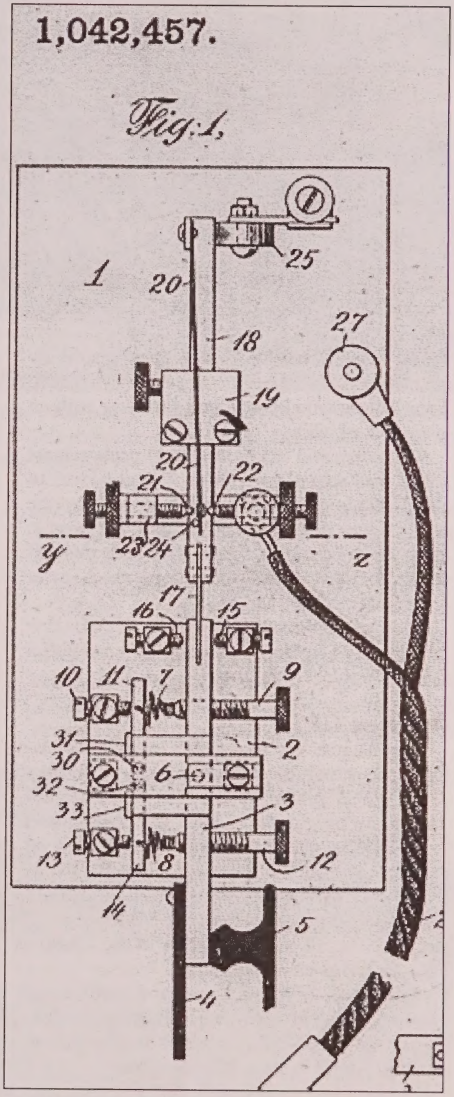
A Vibroplex bug that has never been seen before was recently discovered by Vibroplex collectors Randy Cole K6NW, and Martin Odenbach, DK4XL. No other collectors so far have claimed to have seen one, which could make this bug even rarer than the elusive Vibroplex Midget. The new find represents the fourth patent by Horace G. Martin (#1,042,457) filed on July 1, 1911, and was one of three bugs he invented while he was living in East Rutherford, New Jersey.

Up to now, it has been generally assumed that no production models were ever produced from the design. Considering this recent discovery, I thought it would be timely to document some history associated with this patent. There is significant information available about it because the patent was cited by the Vibroplex Company in a lawsuit that I briefly referred to in February's column.

The suit was titled "The Vibroplex Co. Inc. vs. J.H. Bunnell & Co. Inc. on Patent #1,042,457." One intent of the suit was to provide evidence that would dismiss the claims that the patent was only an experimental design and to confirm that a limited number were actually manufactured.First, some important background on what led up to this lawsuit and why Vibroplex had to resort to use this specific patent in court.

On December 23, 1923, The U.S. District Court for the Southern District of New York issued an injunction against J.H. Bunnell & Co., temporarily stopping them from manufacturing their "Gold Bug" transmitter. Bunnell was ordered to retrieve and dismantle the 24 Gold Bug models known to exist on that date. The injunction was issued based on the "Gold Bug's" infringement on Martin's patent #842,154 owned by the Vibroplex company. This patent represents Martin's "Original" bug design issued on January 22, 1907.

The injunction was issued with only one month remaining on the 17 year term of this patent. Vibroplex took advantage of this one month injunction period and saturated the trades



The drawing for patent #1,042,457.

with ads titled, "Another Victory for the Vibroplex." They also sent out fliers to their customers and dealers in all the major cities of the U.S., Canada, and Mexico proclaiming victory. Never once did they state, though, that this injunction was good for only one month.

This infuriated J.H.Bunnell & Co. After the injunction expired, Bunnell followed with ads telling customers that the Martin patent and injunction expired on January 22, 1924 and to ignore Vibroplex's claims. They also stated they had resumed their production of the "Gold Bug" transmitter. Vibroplex was later found to be still sending out these "Victory Fliers" as late as July of 1924.

Vibroplex's arsenal of effective fundamental patents with broad claims was significantly depleted with the expiration of Martin's "original" patent. But the firm was committed to stopping the competition from Bunnell and decided to try again in court. This time they dug deep into their vaults and pulled out a forgotten patent, # 1,042,457, that still had five years remaining on its term. Bunnell's opinion of this patent was simply, "Forgotten until now, but now resurrected in an attempt to extend the monopoly five years longer."

Vibroplex, relying on arguments surrounding the functions of the coil and vibrator springs, was able to tie up Bunnell in a lower court and appeal trial using this patent, but in the end, lost both cases.A glaringly different design feature of this bug was that it had the opposing dot and dash contacts on either side of the vibrator.

In Martin's "Original" patent he used a "two-piece, single lever" with a vibrator spring that only had one function, to create dots. In patent #1,042,457, he uses a "one-piece, single lever" with a vibrator spring that had two functions. One, to produce dots and secondly, to "restore the parts to normal" after making a dash.

Martin describe's the operation of this bug as follows: "This Machine has a single lever, a pair of contacts for making dots and another pair for making dashes. When the lever is pressed to the right the machine sends short impulses, or dots into the line; when pressed to the left, the lever flexes the main vibrating spring and permits the dash contacts to engage, holding the circuit closed for the length of time desired."

During the lower court case, Martin was called to the stand as a witness for Vibroplex. In this rare testimony, reproduced below, Martin documents the production of this bug. The exchange is between Martin and Murray Corrington. Corrington was the Vibroplex attorney who filed this patent in 1911.

NOVEMBER 12, 1925, NEW YORK

Corrington: "You are the inventor and patentee of the device set forth in the patent in suit No. 1,042,457?"

Martin: "I am."

Corrington: "What is the device for, particularly?"

Martin: Transmitting dots and dashes over a telegraph line or radio."

Corrington: "For sending messages?"

Martin: "Yes."

Corrington: "Did you manufacture and put out and sell any of the machines shown in Exhibit No. 2?" (Exhibit No. 2 being a model of patent # 1,042,457)

Martin: "Yes."

Corrington: "About how many of those machines were put out in actual service?"

Martin: "I should say 100."

Corrington: "And what satisfaction did they give in practical operation?"

Martin: "They were all right. I never had any complaints on them."

Corrington: "And as far as you know are they still in use?"

Martin: "So far as I know they are still in use."

Corrington: "Do you have any interest whatever in the patent?"

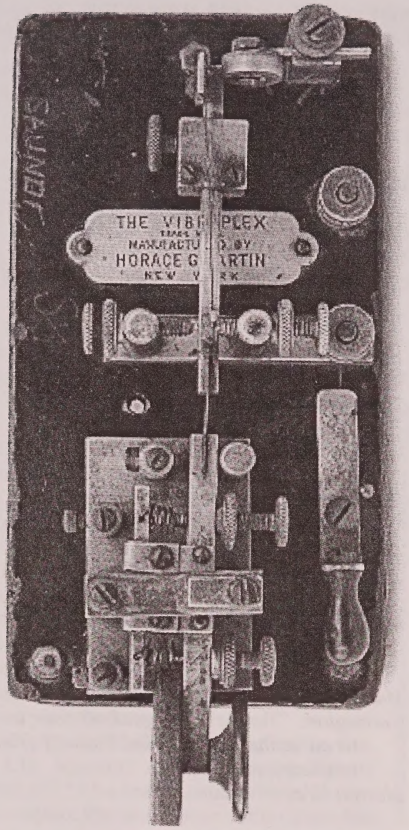
Martin: "None at all."

Corrington: "You have assigned all your interest in the patent to the Plaintiff (Vibroplex) company?"

Martin: "Yes, sir, I have."

Corrington admitted to being a novice when he filed this patent for Martin and stated he made a mistake in claiming that this bug is a single circuit device, meaning that there was one electrical circuit to produce both dots and dashes. This was disclosed when Martin was cross examined by Bunnell's attorney Philip Farnsworth. When Martin was asked to agree that his device used a single circuit to produce both dots and dashes Martin said: "No, Mr. Corrington did that. I do not agree with it." Martin's disagreement with Corrington worked against Vibroplex and helped Bunnell confirm the similarities of their "Gold Bug" to the dual circuit design of the expired "Original" patent. Bunnell questioned the validity of the patent itself over this disagreement.

There is an interesting sidenote about two of the exhibits used in the case. Vibroplex had Martin modify a stock #1,042,457 bug by moving the fixed dash contact next to the key lever to make it similar in operation to a "Gold Bug." He was also instructed to modified a stock "Gold Bug" by adding a fixed dash contact opposite the



The recently-discovered bug representing patent #1,042,457. Photo courtesy of Randy Cole, K6NW.

vibrator to make it look and operate as in the #1,042,457 design. Be on the look out for the possibility that one or both of these professionally modified bugs might turn up at some point.

Even though about 100 bugs were produced from the #1,042,457 design, according to Martin's statement in court, there does not appear to have been any kind of ad campaign to promote the model. Three months after he filed for that patent, on October 27, 1911, Martin filed for another patent that is recognized as covering his "Model-X," a true single-lever, single-circuit machine.

In November of 1911, J.E. Albright, who at that time was the sole selling agent, was advertising a "Single Lever Vibroplex." The ad stated that, "This new 1912 model will carry on wires where other sending machines have been ordered taken off." The ad showed the new "Model-X." One wonders if there was a 1911 model and if it was it possibly patent #1,042,457. Looking back to April of 1911, a bug called the "1911 Model" was indeed being advertised, but the ad shows a Martin Double-Lever bug.

Martin's motivation to go down this design path, according to Corrington, was that he was "working for a single circuit machine" and that he did not reach that point with patent #1,042,457. The low production number, he explained, was due to a decision made by Martin and "his associates" sometime in 1911 to focus on producing two machines, a "one-circuit" machine and a "two-circuit" machine.

The new "Model-X" was obviously their one circuit machine and they decided on patent # 842,154 (the "Original" bug design) over patent #1,042,457 to be their primary two circuit machine, "because there were thousands of them already in use and the operators were accustomed to them." After Vibroplex's loss in appeal, the firm still refused to give up and tried to stop Bunnell by using their "Bug" trademark. This final failed attempt was covered in February's column, "Technical and Legal History of the Bug Trademark."

There are many Vibroplex collectors out there who would like to document the existence of any other examples of this bug. If you have one, a good place to post this information is on the "MorseCode" reflector moderated by AWA member, Lynn Burlingame at http://www.qsl.net/n7cfo/. Several collectors from around the world, many of whom are AWA members, monitor this reflector and will be thrilled to hear from you.

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Journal of the Telegraph, April 20, November 20, 1911

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U.S. Patent, 1,042,457, Horace G. Martin, October 29, 1912

U.S. Patent, 1,043,449, Horace G. Martin, November 5, 1912

U.S. Patent, 1,557,155, John J. Ghegan, October 13, 1925

About Our Authors

PAUL BOHLANDER, W3VVS
Radio Memories From Two Eras

Paul graduated from Dodge Radio and Television Institute, in Radio Engineering, just before the war. He was first licensed as W8VVS in 1941, and held FCC Radio Telephone First and Telegraph Second licenses, both issued in 1941.

In 1941-42, he served as an engineer for station WMRN in Marion, Ohio. In 1942 he returned to Dodge as a code and theory instructor for the 1503 Signal Corps Training unit—sometimes sending practice code to his classes for 8 hours a day.

Paul joined Philco as a field Engineer in 1943—but was almost immediately contracted out to the Navy Bureau of Aeronautics as a radar instructor (operation and maintenance). Later, in this role, still as a civilian noncombatant, he served with a marine squadron in the South Pacific.

After the war, Paul continued with Philco, then with Philco-Ford, then with Philco-Aeronutronic, as a Senior Technical Writer, working primarily on manuals for military equipment. He retired about 1975, but for several years continued developing technical publications on a freelance basis for several major corporations.

CHRISTIAN R. FANDT
Silent Brass—A brief biography of Earl W. Korf, K2IC

Chris became interested in amateur radio and SWL-ing at an early age. He began seriously collecting old radios, TVs and other electronic equipment when he was attending the local community college in Jamestown, NY. Since then, he has gathered a comprehensive collection that includes early battery sets, post-WWII television receivers up to 1952, military communications gear, tube-type communications receivers, test equipment, computers (including mainframes), tech manuals, and service and sales literature.

In 1974, shortly after his time at community college, he began a 24-year career at ACU-RITE, Inc., a worldwide leader in machine tool measuring systems. Chris became an upper-level engineer, working with high-vacuum science and thin-film deposition processes, but was laid off in mid-1998 because of the economic downturn affecting the machine tool industry. He is presently completing a management degree through a college of the State University of New York, after which he hopes to return to the process and machine control engineering field.

An AWA member since mid-1976, Chris is a Board member, regularly helps at the Annual Conference, and has recently become the AWA Club Treasurer.

DAVID W. KRAEUTER
Is This Pup Distempered?

David Kraeuter was born in Homestead, PA in 1941. He holds an M.L.S. degree from the University of Pittsburgh. He has edited *The Pittsburgh Oscillator* and the monograph series of the Pittsburgh Antique Radio Society. Currently, David writes the "New Books and Literature" column for *The OTB*. Since the 1980s he has been interested in making the vast wealth of information buried in national patent publications more accessible to the public. He thinks he has made a beginning in this work with his latest book, *Radio Patent Lists and Index, 1830-1980*, published by the Edwin Mellen Press. In 620 pages, the book tabulates and indexes 6,200 U.S. and British patents issued to 100 radio and television inventors.

F.J. LOTITO, K3DZ
Let's Talk Oscillators—Or Why is My Hartley Squealing Like a Pig?

Frank has a BS in electrical engineering, but for most of his 30-plus-year working career has primarily done mechanical engineering, from a quality point of view, for a large international safety equipment company. He has held the call K3DZ for over 20 years, and also possesses an FCC General Phone license with radar endorsement.

He has been a home brew enthusiast from the start of his interest in amateur radio. His projects have run the gamut from modern solid state VHF and UHF FM synthesized transceivers to designs going back to the early 20s. Frank is most definitely a strong proponent of the "file to fit—fit to file," use whatever you have in your junk box school.

Frank is also Editor of our "Below 535" column.

RICHARD A. PARKS
The Project Radios of Robert J. Adams

Born in 1936, Dick was brought up in Spring-

(continued on page 50)

BELOW 535

EDITED BY **FRANK LOTITO, K3DZ**, 1428 O'BLOCK RD., PITTSBURGH, PA 15239
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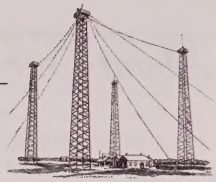

Power Line Carrier Communication

Part 2 (Conclusion) — Large-Scale Power-Line Communication

Large scale PLC systems permit a common power supply to carry both motive and signal power over long distances. Here the intention is to propagate RF energy a substantial distance down a power line.

Examples of large scale PLC systems are:

(1) In 1916 a *QST* article (6) described a simple crystal receiver use to copy a powerful US Navy spark transmitter. The author's receiver used the 110 volt AC power line as an antenna, a practice the *QST* Editor noted as potentially dangerous. The author discovered that his power line was long enough and of sufficient quality to pick up the transmitter's signal. The transmitter was some 600 miles away from the author's receiver installation. (This is not exactly PLC communications in the strictest sense. The Navy never intended to broadcast a signal over a local power line.)

(2) There was a flurry of amateur activity using simple PLC designs during the World War II era because of the prohibition on conventional amateur transmission (7). The carrier frequency was typically in the range of 150 kHz. CW was the favored modulation mode since it made for simple transmitter construction. The low-frequency carrier was used because power line radiation was significantly lower than at HF, and propagation losses at the low frequencies were significantly lower.

The intention of these amateur designs was "local area" communication, not DX communication. It was well understood that communications was limited due to the presence of transformers and power-factor-correcting shunt capacitors, the rather high power line dielectric losses at RF, and the need to use low power to avid interference to others..

Figure 5 illustrates a World War II-era PLC transmitter and receiver as described by Byron Goodman in *QST* (8). Goodman's system operated in the 160 to 200 kHz range. The transmitter was a one-tube triode-connected 6L6 Hartley. B+ keying was used, a dangerous practice without the use of a keying relay to isolate the key from high voltage. The transmitter was coupled to an un-bypassed AC power line using a fixed link (L2). A crude matching device maximized RF power transfer to the power line by selecting one or more of the fixed capacitors C5, C6, and C7 to be placed in series with the link.

The receiver was a single-tube "up converter" employing a 6SA7 pentagrid converter tube.The receiver's input circuit (L1, C1 and C2) was tuned to the PLC frequency (175 kHz) and is connected to the 60 Hz AC power line through switch S1 and capacitor C9. If the receiver's local

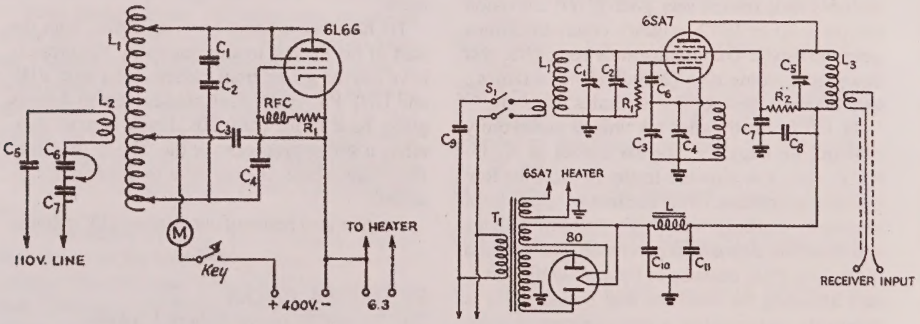

Fig. 5. Goodman's 160-200 kHz Hartley Oscillator (above) and Receiving Up-Converter. From March, 1942 QST.

oscillator circuit (C3 and C4 with associated tapped cathode inductor) was tuned to 1800 kHz and the plate circuit, L3 and C5 tuned to 1975 kHz, one of the heterodyne outputs would be at 1975 kHz. Choosing 1975 kHz as the output, the PLC signal could be monitored with a communications receiver connected to a link coil located at the cold end of L3.

In today's world commercial PLC applications include means by which a remote facility on a power grid could signal a monitoring station and then receive commands from the monitoring station. By today's standards the data information rate is quite low. However the signal coding technique is quite modern, usually employing a form of PSK.

The "information carrier frequency" can be below 100 kHz to well over 250 kHz. There are also PLC systems where the carrier frequency is well over 3 MHz. Well-designed narrow band filters and noise limiting circuits, today as in the past, are a must to improve the signal-to-noise ratio regardless of the carrier frequency.

Sometimes local entertainment and news, including AM and FM radio programs, are broadcast using PLC techniques. This technique goes back to the early 1920s. See the search engine at (9) to find early articles on the subject.

One example is the use of power lines by college radio stations to broadcast to dormitories and other campus facilities. The usual transmission frequency is a broadcast frequency not used in that geographic area. The built-in antennas of the student's personal receivers pick up the PLC system's signal being is radiated from the building's power line.

Other PLC devices have found their way into the consumer, business and industrial world. Examples are baby monitors, doorbell signaling devices, and FM voice, control and data communications systems used in mines and other industrial facilities. These devices operated on frequencies ranging from a few 10s of kHz well into the MF band.

AC power lines and where, available, DC power lines have not been the only conduit for PLC systems. Telephone lines have also been used. The latter application has not gained much favor due to a high risk of disturbing the telephone systems.

PLC technology has matured to make good use of the huge network of 50- and 60-Hz power distribution systems woven just over, and in some cases just under, a good part of the earth's surface. These power lines include thread their way through most homes, offices and buildings. Hence the most serious PLC problem is radiation of the r.f. signal from the lines.

Due to the power lines' wire-to-wire spacing, or r.f. current unbalance, the r.f. signal may not be adequately contained in the "transmission line." Additionally, to increase the reliability of some PLC systems, the r.f. level might be increased to make sure a reliable signal-to-noise ratio. This further adds to the co-channel interference potential.

Finally, the carriers and bandwidth of some PLC signals extend well into the HF range. With the increasing use of radiating PLC signals, some test results suggest a definite possibility that, in large areas of the world, a narrow-bandwidth HF communication receiver's S-meter needle will be pegged at S9 or higher. Many areas already experience this flood of power-line-radiated noise at LF and MF.

This article cannot do justice to either the pro and con PLC arguments being hotly debated in the electronic press and meeting rooms. There is a wealth of information on the Internet, starting with the ARRL, http//www.arrl.org, and the RSGB, http://www.rsgb.org, web sites. Readers are encouraged to make themselves familiar with the literature these and other organizations' make available concerning the pros and cons of modern PLC communications. Use "PLC," "power line communications," or "wired wireless" in your favorite Internet search engines.

REFERENCES

(6) W. A. Meyer, "Receiving NAA Over An AC Power Line," *QST*, June 1916

(7) Some additional historical *QST* references on power line communication
1923: June, p. 64. **1929:** May, pp. 19,20,23. **1934:** July, pp. 60,62; Sept, p 12. **1940** Feb., pp. 34-37; April, p. 102. **1942:** June, p. 34; Aug., p. 50; Oct, p. 42; Nov, p.48; Dec, p. 48. **1943:** Jan., p. 68; March, pp. 33,34; April, p. 41; May, p. 32; July, p. 38; Aug, p. 51; Sept, p. 50; Oct, p. 52; Nov, p. 11; Dec., p.59. **1944:** Feb., p. 53; April, p. 39; May, p. 44; June, p. 42; Aug, p.44; Oct., p.38.

(8) Byron Goodman, "Wired Wireless," *QST*, March 1942 (from "*QST* View"), pages 12-15, 58, 60 & 62

(9) http://earlyradiohistory.us/

BY BILL FIZETTE, W2DGB

A STRUCTURED APPROACH TO FIXING UP THOSE NICE OLD RADIOS

Rehabbing a Home-Built Communication Receiver

Readers who have been following this column over the past few years are by now aware of many of the variables that are encountered when attempting to repair an "old radio." This month we are going to toss some new ingredients into the pot as we repair a flea-market find. It is the Byron Goodman amateur receiver that was featured in the January, 1953 issue of *QST*, and the ARRL *Handbooks* during the 1950s. See my "The Communication Receiver" column in this issue for more details.

Initial inspection of this radio left me with a positive impression. The builder of 50 years ago had reproduced the construction article faithfully, using new parts without obvious substitution. He even provided a new Bud cabinet. He put a lot of effort and time and money into the project, but there was a good chance that it had never worked properly, if at all. (Perhaps that was the reason for the two large X marks scratched into the i.f. transformer bracket.) As I got into the job, I became aware of some of the problems he faced, and I sympathized.

Before I did anything to the receiver, I needed a power supply. Another flea-market find, a small receiver power supply with two VR tubes, provided the basis for that. It didn't take too long to adapt it to provide the necessary voltages. With that out of the way, I made up a power cable and took a hard look at the radio.

The most obvious problem was the rust on all the ferrous hardware, notably the ceramic tube-socket mounts and the ground lugs. Because of that, my original idea of simply powering up the receiver went by the wayside. Without good chassis grounds, the set would not operate. There were also several of the notorious "Black Beauty" capacitors, which have a high failure rate. (Actually, after 50 years almost any 1950s by-pass capacitor will show considerable leakage.)

Eventually I gave up trying to patch the problems and rebuilt the receiver using most of the original parts, cleaning and checking each component as I proceeded. In the process I discovered two cold-solder joints, which surely had added to the original builder's problems.

The cans for the 100-kHz i.f.s and the BFO coil were mounted to the chassis with steel spade lugs and nuts. These were rusted fast. To avoid damaging the fragile aluminum cans, I resorted to drilling out the brass rivets holding the spade lugs. The lugs were then replaced with new ones fastened with small bolts. The modifications inside the cans were checked, and one of the 100-µF capacitors replaced. The coils were bench-peaked at 100 kHz, using a Heath signal generator, a small hand-held frequency counter, and the trusty Heath VTVM with an RF probe.

The special 1700 kHz Millen i.f. transformer was removed and checked, and one of the original fixed capacitors and the connecting wires replaced. A new mounting bracket was fabricated out of thin flashing aluminum. This transformer was also bench-peaked and then set aside to be remounted later. The two 0.0015 µF capacitors in the BFO, obviously purchased new, were checked and one was found to be 40% low. This emphasizes the need to check every part, even a new one, before it is installed.

Note: The two pieces of test equipment used in this job, not emphasized in prior columns, were the frequency counter and a small digital capacitor checker. These were relatively inexpensive products of recent times, and it is unlikely that the original builder had equivalent test gear. He had trust that the manufacturers' quality control would give him good parts. Unfortunately that didn't always happen.

When checking a project constructed from a journal article, one should always to be wary of the errors which often creep into the text and schematic. For example, the oscillator coil hookup shown in the schematic was incorrect. When I connected it this way, the results were ear shattering. The correct connections were finally located buried in the adjustments section of the article.

Another source of errors lies in the way component values were expressed. In the 1955 *Handbook* article, which the original constructor used and which came with the radio, resistor R1 is clearly given as 15 megohms. The correct value,

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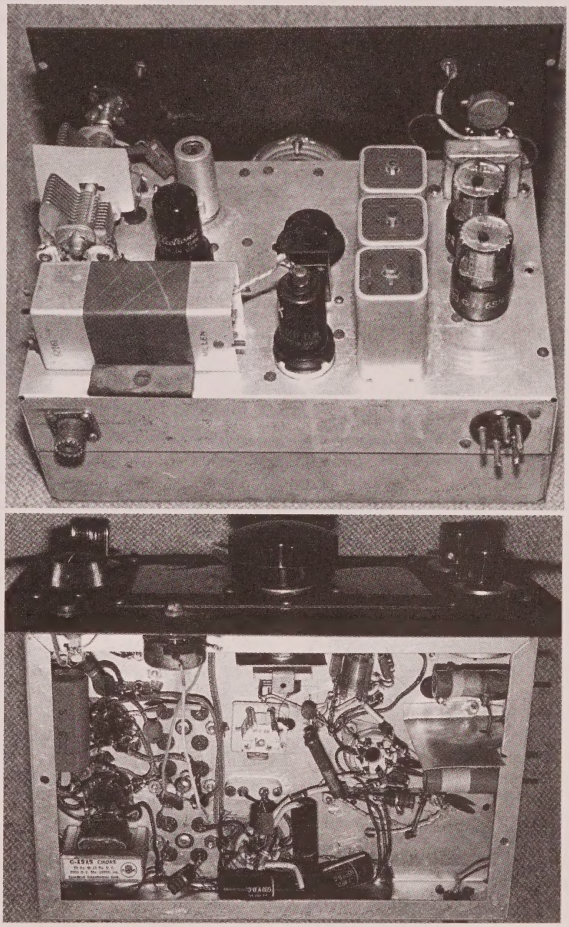
given in later editions is 0.15 meg. If you have questions about possible errors, do a literature search for similar circuits and for any corrections which may have been published later. A good library helps.

When rewiring the set, new ground lugs were used and new wire was used as necessary. The two gain controls were cleaned and checked with the VTVM for proper action. The tubes were checked with a good mutual conductance checker and found to be good. Many resistor values were found to have gone high, and were replaced. While the text didn't mention the need for a shielded lead between the 6K8 and the RF gain control, and I didn't originally install one, the accompanying photo did show such a lead. When the set screamed in protest, I replaced the unshielded wire with a shielded one. It helped.

After the voltages were checked, the adjustment procedure as given by the author was attempted. It turned out to be a chore. The converter cathode current was supposed to be 50 microamps, but it measured 90 (yes, I checked the meter). I was able to get it down to 50 μA, but it required a 500,000-ohm resistor. This was an unacceptable situation, and I replaced the original 3300-ohm resistor. The oscillator voltage adjustment was supposed to be under 10 volts, but actually read about 40 volts. Finally I ignored all this and concentrated on controlling the wild regeneration and getting readable signals through the set.

And I did get them. Both oscillators worked and the front end performed as stated, with the 80-meter band at full capacity and the 40-meter band at the other end. CHU time signals came in quite nicely on 7335, and strong signals could be heard on a small loudspeaker. The adjustments of the 100-kHz transformers were critical, and the bandwidth was almost too narrow for phone reception. The BFO worked satisfactorily. It was also apparent that a short bench antenna would not work with this set; a long outside wire is a must. Actually, one test was done to match the station antenna into the receiver to see how the signal levels are affected, and it did make a difference in signal strength.

Goodman presented this receiver for ham use, mainly CW, and when properly adjusted it probably worked quite well on both 40 and 80 in the 1950s. Other bands could be covered by front-end converters. This particular set does need more work, especially in the 100-kHz i.f. section, and the temptation to continue on is strong. If new information develops it I'll report it later in this column.



Two views of the Goodman superhet as received. The set's aluminum chassis was supported by a steel chassis bolted to it—probably to add structural rigidity (see top view). The large pot mounted under the tuning dial, seen in bottom view, was not original and was removed during rebuilding.

BREADBOARDING

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E-MAIL: DPARKS@EROLS.COM. *PLEASE INCLUDE SASE FOR REPLY.*

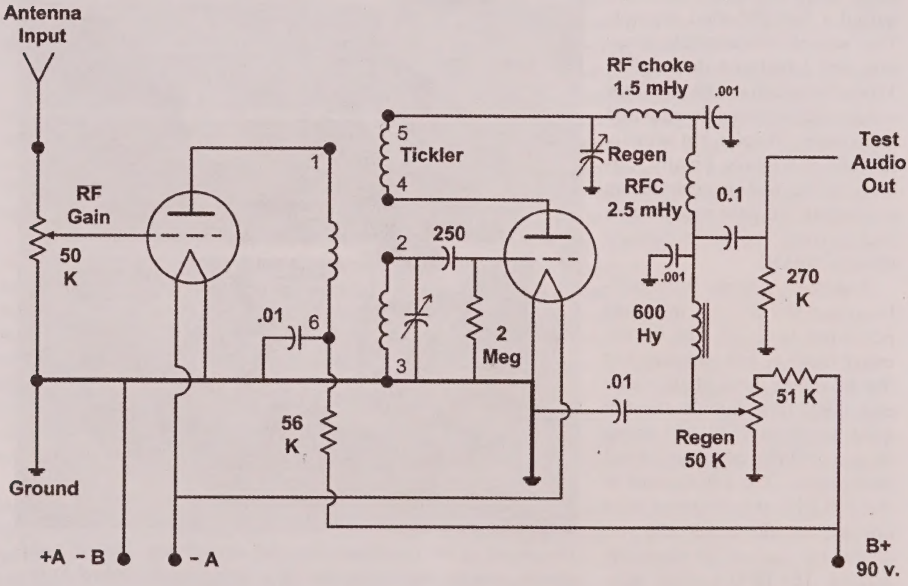
Bring Historical Circuits to Life On Your Workbench!

A Three-Audion Breadboard Receiver

I still have some repro spherical audions on my hands (see "Breadboarding" for May, 2003), so here is the first of what I think will be two columns on breadboarding a three-tube receiver using these tubes. Again I will acknowledge Mr. C. F. "Rock" Rockey, whose book Secrets of Homebuilt Regenerative Receivers (1) will guide me during this work (1). Let's review the history of the regenerative circuit I'm going to use: About 1912, Edwin Howard Armstrong, working with early triodes, discovered that if the amplified signal at the plate is coupled back in part and in phase to the grid, then a reinforcement of the grid signal takes place. Of course, if too much reinforcement, or positive feedback, takes place; the tube begins to oscillate.

Armstrong's receiver circuit did the coupling by means of an extra coil—he called it a "tickler"— in the plate lead. Varying the coil tap, the position of the coils, and even the filament current changed the amount of coupling and therefore the amount of regeneration. The tube alone might have a gain of five or ten, but with controlled positive feedback, he could achieve orders of magnitude more gain in the earphones.

As the circuit approached maximum controlled gain, Armstrong could hear a "hiss" in the phones—this was radio noise, of course. Then, with a "plop," the tube would begin to oscillate and apparent gain dropped way down. Folks who built or bought the early regenerative



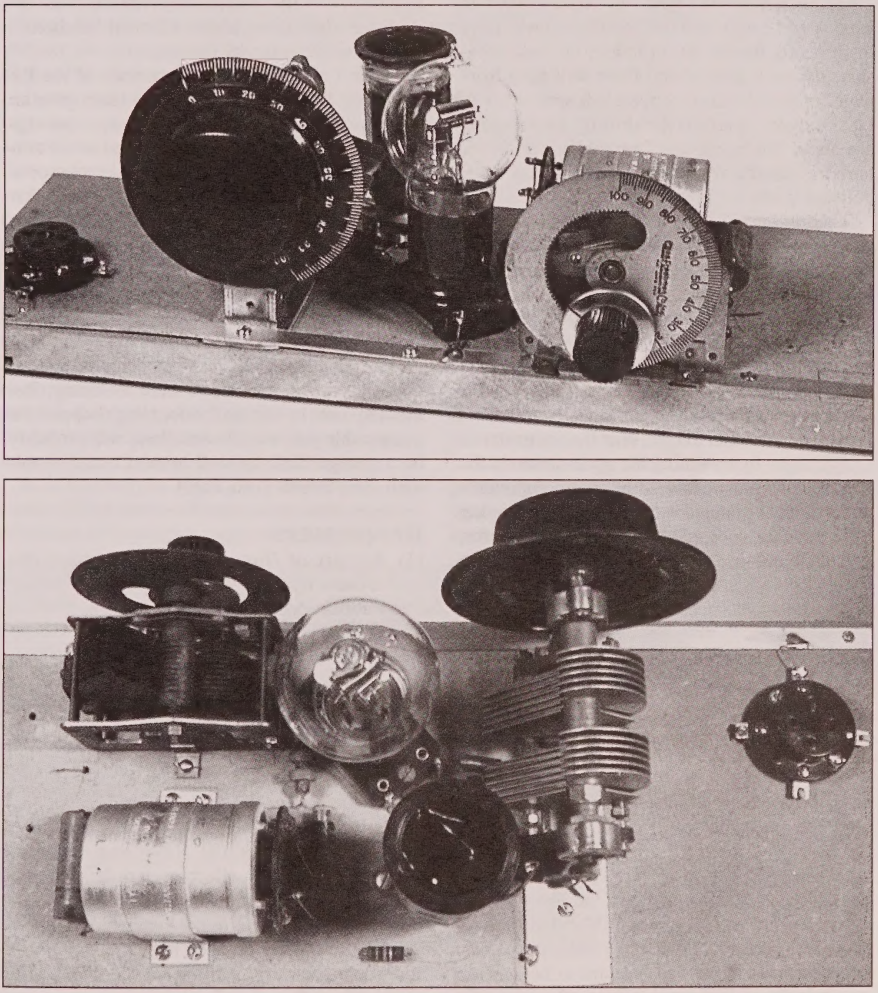
Schematic shows current state of receiver development. Design tweaks and addition of audio stage to come later.

receivers were instructed to operate just short of the "plop," so as to avoid sending low-power RF carriers all over their neighborhoods. Later, such receivers got around this, in part, by adding an RF amplifying stage ahead of the detector. This helped isolate the antenna system from the potentially oscillating element.

My idea for this set is to include an RF stage, a regenerative detector, and one stage of audio, all using the repro tubes I have on hand. I want to use plug-in coils, too, to see how well the circuit can be made to work above the broadcast band. The schematic diagram shows the circuit I'm starting with. So far, it's a two-tube receiver (the audio stage will be added later).

As you can see, the simple, untuned RF stage applies a variable RF signal to the primary of the six-pin coil. I'm hoping to keep the coupling loose enough to keep the detector from "pulling" on strong signals, yet have enough gain available to respond to weak stations, too. I have four NOS plug-in forms in the junk box and I'm going to start with the BC band coils first.

There are two good ways to control regeneration: by use of a "throttle capacitor" at the cold side of the tickler winding, and by varying the plate voltage of the detector tube. This breadboard will use both means, at least to begin with.



Two views of the receiver circuit as breadboarded so far.

Finally, I have scrounged a desirable high-inductance choke (600 Henrys) from a junked World War II surplus LM Frequency Meter; it is used to develop the rectified audio as a useful output signal.

Rocky says that battleship construction is essential to make high-frequency operation stable, so all the parts are securely mounted on the piece of dense ¾-inch composition board I chose for this project. My goal is to keep the RF leads as short as possible in the detector circuitry, so the tube, tuning capacitor, and RF coil are mounted close together.

At the same time, I have final appearance of the receiver in mind. I found an empty cabinet on Ebay a while ago, and the breadboard will have to fit neatly inside. Accordingly, the base measures 16 by 6 inches, and there will be a front panel made of heavy copperclad, sprayed with black crackle after all the drilling and hacking are done. The board has four rubber feet at the corners, leaving room underneath to run wires between parts.

The tuning capacitor is a real goodie—a two-gang National piece having 200 pF in each section and with a 270 degree full-scale rotation. It would be nice to have a matching 270 degree vernier dial for the panel—time will tell. The junk box yielded three old-time tube sockets, and the throttle capacitor is an old Freshman item with 390 pF of available capacitance and a vernier drive. The six-pin coil socket is low-loss porcelain—another World War II surplus item.

I began by mounting the parts shown in the photograph, plus a few additional components underneath. I planned out the wire routing, dug little trenches with a Dremel tool for the wires, and made one-inch holes about a half inch deep for bypass caps and resistors. I wound the tuning coil by trial and error, making sure I could tune to the edges of the broadcast band by removing secondary turns (the center winding).

The lower winding is a primary and the tickler is the top winding, arranged with taps every three turns that have their connections inside the coil form. It turned out that all 21 turns worked best for the tickler winding.

Another thing that became obvious was that the throttle capacitor was not giving smooth control of regeneration. Varying the detector plate voltage did work smoothly, so the next round of development will use only that method for regeneration control. Just to keep a grip on reality, I repeated all the tests on this breadboard using improved tubes: a pair of NOS 30s, whose characteristics are a little better than these bright-filament "audions". The 30s work better, by the way.

When I analyzed the performance of the RF amplifier, I found that the repro audion gave an effective gain of about 2 for a steady input signal from the RF generator, measured at the amplifier plate. When we looked into detector coupling in our beginning columns, we showed that it's essential to keep the antenna from loading the detector tank or else tuning will become unacceptably broad.

The same thing holds true here for coupling the RF tube's plate resistance to the detector. Coupling to the detector tank has to be kept very loose, and even the 20 primary turns of cotton-covered wire shown above were too many. Removing turns to lighten the coupling dropped the measurable gain even lower; there will probably be a change there as well in next month's column. Stay tuned! (heh, heh.)

REFERENCES:

(1) *Secrets of Homebuilt Regenerative Receivers* by C.F. "Rock" Rockey, Lindsay Publications, Inc. Bradley. Il. Rev. 1997

ABOUT THE AUTHORS, *continued from page 43*

field, MA, where his dad worked in the Westinghouse plant that had manufactured the RADA sets. The factory junkyards provided him with ample stocks of rejected chassis ripe for parts-picking. After serving in the Navy (1953-1957), he entered University of Maryland and received his BSEE in 1961. Beginning in 1967, he made a career move that led him to become an expert in the identification of aircraft using computerized radar signal processing (an extension of the old military IFF techniques).

In 1981 he became a consultant in this field, working mostly for the Navy and traveling worldwide for data collection and development testing. With the end of the cold war, Dick now finds himself semi-retired, which makes it possible for *The OTB* to draw on his varied talents. In addition to this current article, he is Editor of *The OTB's* "Breadboarding" column.

BY RICHARD A. PARKS

THE PROJECT RADIOS OF ROBERT J. ADAMS

Background

Early in the year 2000, at a meeting of MAARC (Mid-Atlantic Antique Radio Club), I noticed a group of members standing closely around a table on which was displayed an unusually well-made radio. Fabricated of shiny aluminum, the receiver had been removed from its cabinet for inspection. The set proved to be a clone of the famous National SW-3.

It was built by Robert J. Adams, a MAARC member living in Takoma Park, Md. We were amazed at the clean layout and neat execution of this receiver as well as its many thoughtful features. For example, the power supply had been constructed as a removable module and there was a built-in shelf for the plug-in coil set.

Later in the same year I received a letter from Mr Adams regarding an article I had written about a receiver that I had built. This was the beginning of our friendship. He sent me pictures of the SW-3 clone, which he called his Model 1096, as well as documentation for it. I was again greatly impressed, this time by the elegance of his circuitry. I remarked that the details of his set should be presented in an article for the radio community.

Bob died early in 2002 after a short illness. His cousin, Bill Adams, offered me the 1096 receiver as a token of friendship, suggesting I might be the one to write the article. Later I was given the chance to see other examples of the radio projects that Bob had constructed after his retirement. I regard this as a great honor, and what follows is the article that resulted. Some might call these "homebrew" sets, but because of their high standard of workmanship, "project radios" is really a better term.

Adams was born in Washington, DC in 1928. He suffered from tuberculosis in his childhood, and much of his education came from tutors. His parents died before he was 15, after which he lived with relatives. He became interested in radio in his teens and attended a technical school in Richmond, Va.

By the early fifties, he was working at Nems-Clarke in Silver Spring, Md (later Vitro) as a test engineer. Adams won recognition for his creativity and commendations at Vitro for innovations in electronic test methods.

After a heart attack in 1979, Adams retired with 28 years' service and devoted full time to his hobbies of model trains and radio design. He never married and never got a Ham ticket. No fan of new technology, Bob refused to use a computer and foreswore answering machines. He was single-minded, a perfectionist, and a fine craftsman in everything he did.

Model	Date	Circuit	Tube Lineup
1016	?	one-tube regen - battery	1E7GT
Unknown Model	?	2-tube regen - AC	1E7GT, 1E7GT
1026	1993-4*	2-tube regen - AC	3A8GT, 1D8GT
1089	1988	5-tube regen - AC	(?) (?) 6AQ6, 6AQ6, 6AK6
1091/1094	1988	5-tube regen - AC	6S7 or 6U7, 6P7, 6C8-G, 6F8-G, 84/6Z4
1092	?	5-tube regen - AC	Miniature types
1093	1989-90	?-tube regen - AC	Unknown
1094C	1989	4-tube regen - Battery	Miniature types
Reworked 1026	1994	4-tube regen - AC	18FW6A, 18FW6A, 18GD6A, 34GD5A
1094M	4-tube regen - AC	6S7, 6S7,	6S7, 6R7
1096	1995-2000	4-tube regen - AC	12SG7, 6SG7, 12SJ7, 12A6
1097	2000 or 01	similar	Sub-miniature types

*These may be dates of a redesign.

Fig. 1. Radios completed or under construction

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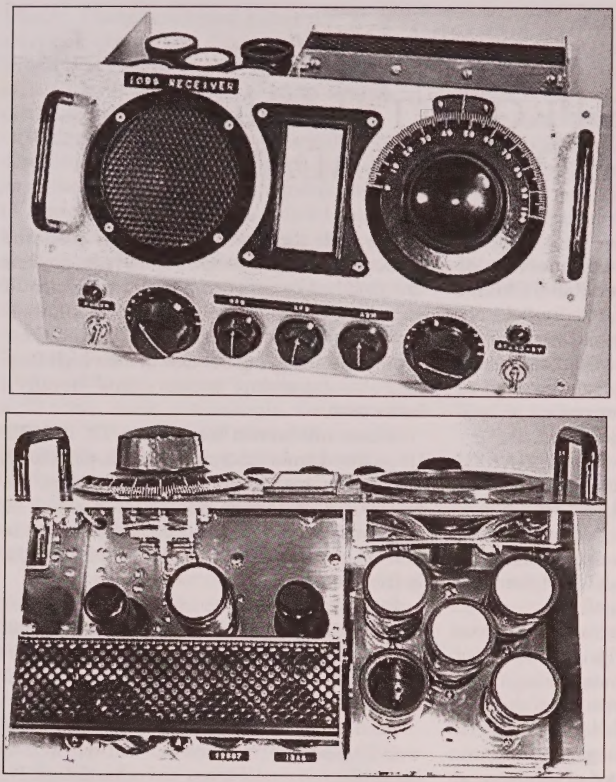


Fig. 2. Front and top of Bob's elegant Model 1096. See text for functions of front-panel controls.

Radio Construction History

A table showing some of Bob's completed and under-construction radios is shown as Figure 1. Using the documentation available so far and doing some electrodetective work, I found that the majority of Adams' sets have similarities to the basic SW-3 design: an RF amplifier stage followed by a regenerative detector and audio stages. Like the SW-3, the receivers all were designed to use hand-wound plug-in coils and to cover segments of short-wave bands using vernier bandspread tuning. Adams progressed and improved each of his designs after the 1026, using two battery-type tubes, to his 1096, complete with a power stage and speaker. Most draw power from the AC line, even if filamentary tubes are used.

With few exceptions, the sets use solid-state power supplies. They were built on stock BUD chassis, with side panels and internal shields added where needed. Front panels are usually of ⅛" aluminum, most beautifully spray-painted with gray metallic enamel. Adams was partial to National Velvet Vernier tuning controls. Wiring is laid out using standoff insulators and ground lugs, with leads kept quite short throughout. Adams made detailed drawings of each part, just as if he were designing a piece of commercial equipment, and even wrote a drawing list for each set.

The Model 1096

Figure 2 shows two views of Bob's Model 1096, which is now in my possession. This radio is complete. On the front panel we see toggle switches and indicators for AC power and standby/operate. Between them are rotary controls for (from left to right) regeneration, RF gain, audio gain, audio bandwidth, and the RF preselector (another vernier). The front-panel tuning (bandspread) capacitor has three plates.

The tubes are single-ended all-metal octal types. Adams used the best design elements from his earlier sets: complete controls, regulated solid-state power supply, shielded RF and Detector sections, internal coil storage, bandspread tuning in the SW broadcast bands between 6 and 16 MHz. There are three selectable audio bandwidths and a power pentode for the output stage. The RF stage is a wideband preselector.

To tune the set, one first sets the RF Tuning control to a position recorded on the front panel log chart, then tunes through the desired band using the main (bandspread) tuning control. The detector uses heavily decoupled circuitry and has unusually smooth control of regeneration by means of screen voltage control.

The 6SS7 detector tube's heater operates on regulated DC. Audio bandwidth is selectable for 3.3 kHz, 2.3 kHz, or 1.25 kHz - good for CW reception. The audio driver is a high-gain pentode and a 12A6 power tube drives a four-inch PM speaker. After all the audio filtering, there is a small amount of negative feedback around the output tube.

Design of this set began in September 1995, and Adams settled on the final schematic (Figure 3) in November of 1999, according to the drawing list he maintained.

The detector coils tune the following ranges:

Coil	Tuning Range, MHz
49 M	5.900 - 6.218
40 M	6.980 - 7.520
31 M	9.325 - 10.082
25 M	11.531 - 12.095
20 M	14.000 - 14.350
19 M	14.945 - 15.718

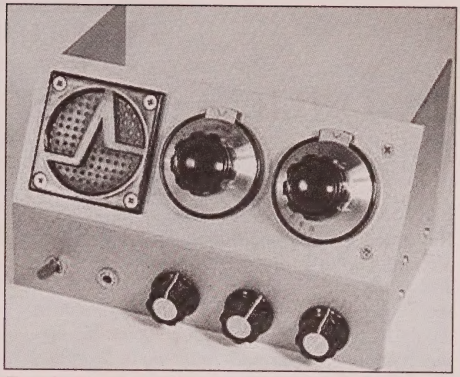


Fig. 3. Front panel and chassis of the unfinished Model 1097.

I've tested this radio with the coils that are with the set now. It's plenty sensitive, and the regen control is so smooth it acts like another RF gain control. You just can't tell when regeneration begins—there's no sudden "plop". If you push the regen control too far, overload happens, but the audio quality is fine before that.

Listening to the 1096

I have two decent antennas for SW listening—a long N-S wire of about 200 feet, and a vertical that gets about 40 feet above ground level. During two listening periods, day and night, I logged plenty of stations. By far the long wire brought in more signals. The 40-meter Ham band occupies about half of the span of the bandspread dial, so it's pretty easy to separate stations. By tuning very carefully you can make SSB signals understandable, and CW is easily received by setting the regen control just over the oscillation point.

As with all receivers of this kind, the controls interact, so it's necessary to ride the RF gain and regeneration controls while tuning in order to

(continued on page 56)

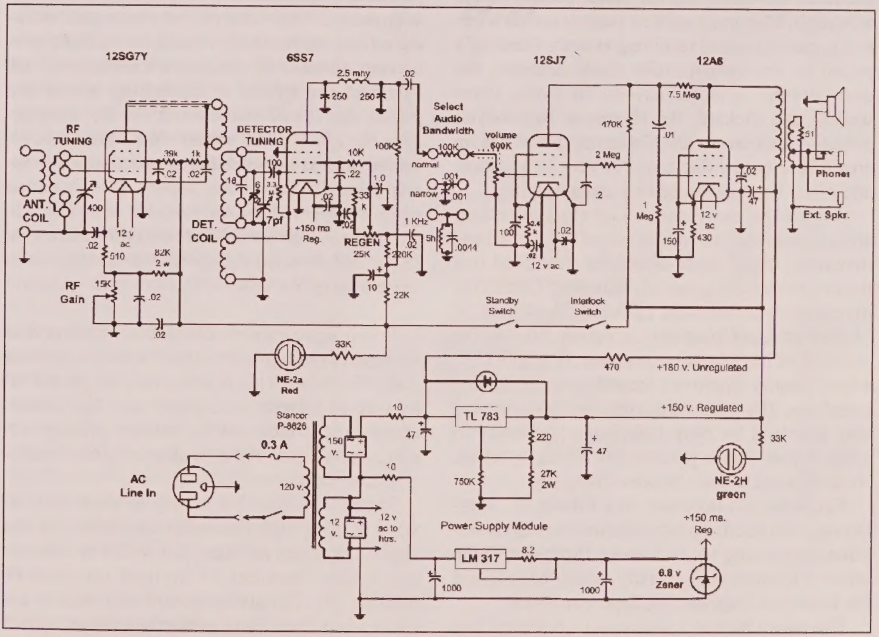


Fig. 4. Schematic of the Model 1096.

BY WILLIAM E. DENK, W3IGU

TWO RICH MINDS— ONE POOR INVENTION

Reprinted From *The Antique Radio Gazette*[1]
Volume 15, No 1 (Spring, 1987)

An early patent by legendary inventors Edwin Armstrong and Michael Pupin confirms the former's long-time interest in reducing radio static. Though the application of regeneration to antenna circuits as a noise limiting technique was a dead end, it did foreshadow Armstrong's eventual development of Frequency Modulation. Writer Bill Denk was a long-time author of The OTB's *book review column*

Even before the founding of the first organizations devoted to the preservation of the wireless history and equipment, this writer had started his collection of patents having special significance in the early development of the communications technologies. The collection includes Edison's patent on the phonograph, Bell's patent on the telephone, the Morse patents on the telegraph, Marconi's earliest patents on his wireless transmitting and receiving system, Fleming's patent on the vacuum tube diode detector, the early crystal detector patents of Bose, Dunwoody, and Pickard, the Hazeltine Neutrodyne patent—hundreds in all. Collecting patents is an area of our hobby that requires very little space, and it can be most interesting and revealing.

One of the early patents in my collection, added because of the eminence of the named co-inventors, might have been later discarded had the inventors been a pair of unknowns. One of the inventors was Michael I. Pupin, Professor of Mathematics at Columbia University. He was the inventor of the telephone repeater, or Pupin coil, which greatly improved long-distance land-line telephony. His patent covering that development was acquired by Bell Telephone Company in 1901. Other Pupin patents, on tuning systems, were licensed to the Marconi Company.

The other co-inventor was Edwin H. Armstrong, who needs no introduction to radio historians. Armstrong studied under Professor Pupin while at Columbia University, where he received his Electrical Engineering degree in 1913.

The patent here in question is U .S. Patent No. 1,336,378, "Antenna with Distributed Positive Resistance." The application was filed October 1, 1915, and issued April 6, 1920. The single page of drawings is reproduced here in its entirety. To place this patent in historical perspective. note that de Forest filed his patent application on the triode on January 29, 1907; Armstrong filed his application on the regenerative detector on October 29, 1913, and that on the superheterodyne receiver on February 8, 1919.

For an understanding of the objective of Messrs. Pupin and Armstrong which, broadly, was to reduce the effects of static on radio reception, the second paragraph of the patent specification is reproduced below in its entirety:

The invention relates to receiving wave conductors which are loaded with resistance in order to screen them against the disturbing effects of electrical waves, and particularly those waves which have the character of electrical pulses of short duration, known in the art as "atmospherics" or "strays." A resistance introduced into the receiving conductor, called the receiving antenna in wireless transmissions, will diminish the effects of disturbing waves and pulses, but it will also diminish to the same degree the effect of the waves which are to be received, ***unless the introduced resistance is properly placed****...* (emphasis added) *This invention gives definite rules which enable one skilled in the art to distribute the introduced resistance so that it will diminish the effect of disturbing waves more than of the waves which are to be received.*

Referring to Figure 1 of the drawing there is an antenna (3) of high- resistance wire (as much as 300,000 ohms). This is connected to ground (4) by way of primary inductors 1 and 22. A series resistor (5) is included the antenna primary circuit; it may equal about "a quarter of the total introduced resistance."

Figure 2 is included merely to show that, instead of using high resistance wire in the antenna (quite a practical problem!), it would be easier to use a large number of lumped resistors (6 through 18). The inventors note that such an antenna would "act like a perfectly uniform wire of the same total resistance, if the lumps are so

spaced that there are several per wavelength of the waves to be received." According to the inventors, the function of resistor 5 "is to dissipate the electromagnetic energy during its passage from the antenna to the receiving apparatus."

For the moment, ignore the entire vacuum tube circuit and notice only that detector 46 is coupled to antenna primary coil 22 by way of coupling coil 45. Ignore also the interposed coil 21 which is part of the vacuum tube circuit. In describing this arrangement, the inventors make the unsupported statement that "we find that in such an antenna the effective resistance for waves to be received is a fractional part of the total resistance, whereas for electrical pulses of short duration the effective resistance is substantially equal to the total resistance of the antenna." Their "pulses of short duration" are, of course, the static against which the inventors desired to discriminate.

Claim 1 of the patent broadly covers an antenna of the type described so far. It reads:

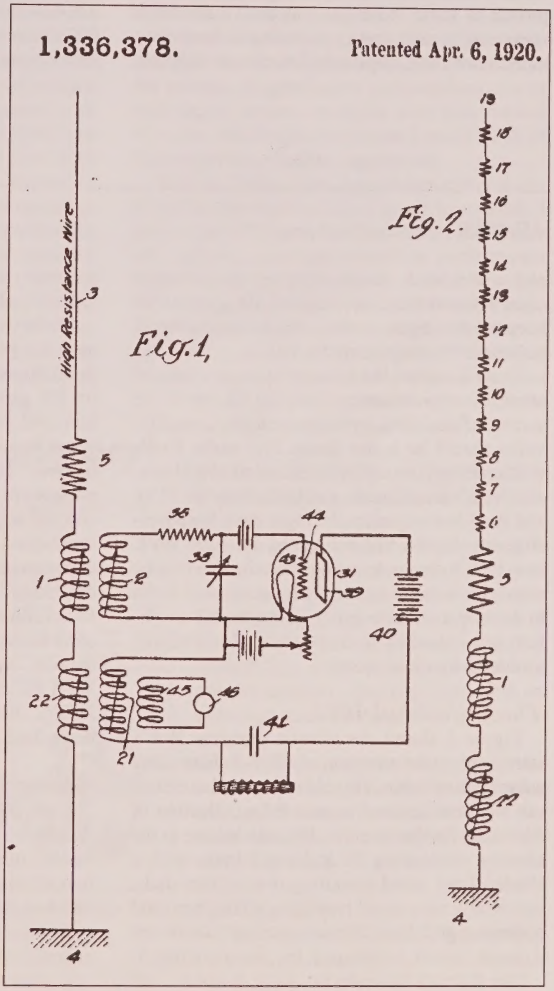
1. A receiving conductor for wireless wave transmission having a resistance load sufficiently high to screen the system effectively against disturbing electromagnetic waves impressed upon the conductor, the said resistance load being distributed along the conductor with substantial uniformity with respect to the wavelengths developed upon the conductor by the received signals.

Now to the vacuum tube circuit — and here the patent becomes more interesting, though no more convincing. The inventors describe the circuit as "a resistance compensator... employed for the purpose of compensating a large resistance introduced into an antenna." This compensator is, simply, a regenerative system that reintroduces energy, taken from the antenna and applied to the grid circuit, back into the antenna circuit, via plate coil 21, in such phase as to introduce a negative resistance into the antenna.

In the words of the inventors, "This produces in the antenna a negative resistance reaction capable of reducing the resistance (of the antenna) to any predetermined limit for waves of selected frequency." The inventors seem to have believed that the high, built-in antenna resistance would be greatly diminished for the desired signals, while remaining very high for atmospherics, thus discriminating strongly against static interference.

Claim 2 of the patent is like claim 1, reproduced above, but adds the following:

. . .and a resistance compensator connected to the conductor and adapted to reduce its effective resistance to any predetermined limit for received signals.



The writer found no reference to this patent in Maclauren's fine book *Invention and Innovation in the Radio Industry* (Macmillan Co., 1949), and didn't really expect to, but the following significant statement appears on page 184. "One of the major problems which Armstrong had been eager to solve was the elimination of static. His first work with Pupin had been in this field, and for eight years (1914-1922) he had wrestled with the task without making significant progress." Maclauren adds that, in an interview, Armstrong stated, "My early failures here were a chastening experience and it was two years before I regained sufficient confidence to tackle this particular problem once more."

As we all know now, Armstrong's new approach to static reduction was use of the UHF spectrum, higher power, wide-band frequency modulation, and amplitude limiters, or clippers, at the receiver.

On balance, it seems fair to conclude that the Pupin & Armstrong patent does not belong my the discard pile. Instead it will be retained as an interesting but unproductive step in man's long effort to minimize the effects of atmospherics on radio reception. And for us more ordinary toilers, it has to be reassuring to know that occasional failure need not preclude ultimate success.

[1] The Antique Radio Gazette *was the official publication of the Antique Radio Club of America. ARCA merged with The Antique Wireless Association in the spring of 1994, and the content that appeared in the Gazette during its 1972-1994 publishing history is now part of the AWA archives. Though edited to conform to* The OTB*'s current standards of style, this article appears essentially as originally published.*

ADAMS, *continued from page 53*

pick out a weak station between two stronger ones. I found that adjusting the RF gain while keeping the regen control steady was a useful technique to compensate for fading.

There's a short but noticeable lag in regeneration behavior because of the 1.0 uF cap at the screen of the detector tube—maybe a smaller value would be better there. The audio bandwidth settings are useful in crowded conditions, and there's lots of audio available from the 12A6 and the Alnico speaker. It might have been possible for Adams to have added a simple AVC loop to this design by using an audio driver tube with a built-in diode, rectifying recovered audio to develop a variable grid bias for the RF amplifier, but I shudder to think about the feedback problems involved there!

The Unfinished 1097

Figure 4 shows the chassis that was Bob's starting point for a version of a SW-3 clone using subminiature tubes. He told me he had sketched out his ideas and had assembled a collection of SM tubes for the receiver. But all we have is the chassis, measuring 5½ × 3½ × 1 inch, with a slanted front panel mounting two vernier dials, one with a very small two-gang tuning cap, and a speaker grill for a 1½ inch speaker. Below are a power switch, a mini-jack for phones, a tiny 5-position rotary switch, a 50K pot, and another pot with a DPST switch.

I believe the two vernier controls would have been for preselector and detector tuning, as on the 1096, while the other controls would provide for RF gain or antenna coupling (?), regeneration, and AF gain. Faintly marked in ink on the upper lip of the chassis underneath is the model number "1097." I wish I knew exactly what his plans were for this set. It's tempting to finish it, and just as good an idea to leave it this way as an untouched sample of Bob's high standard of workmanship. In the early days of ham radio, the one-off rigs shown in the yearly *ARRL Handbooks* showed a level of planning and quality of construction that I thought had disappeared with the easy availability of modern commercial gear. With his collection of project radios, Robert Adams showed us what can still be done by one individual, given time and talent enough.

Acknowledgement

I am indebted to Bob Adams' cousin, Bill Adams of Bowie, Md. for his generous contributions of materials and information in preparation of this article. No mean craftsman himself, Bill was devoted to his cousin, and often served as Bob's arms and legs during life. He is now the executor of the estate.

BY DAVID W. KRAEUTER

Is This Pup Distempered?

Most radio repair persons are familiar with "tough dog" cases—those repair diagnoses or processes that extend beyond the challenging into the downright frustrating. Such is the case with my Crosley Pup; hence the title for this article.

I got my Pup at last year's AWA conference. It is in very good condition, so I was willing to pay the asking price (less $10 because the asking price took all the money I had on me). Of course I had to try it out as soon as I got home. I found the 1.1 VDC filament of the WD-12 was open but I was lucky enough to find a good replacement for the tube. (The Pup can also be operated with an 01A with 5 VDC across its filament, but if you swap between tube types use caution. The WD-12 does NOT want 5 VDC across its filament!)

Reception was, to put it mildly, disappointing. With my 75-foot long-wire antenna attached, the Pup received only two local stations. The strongest one was heard from one end of the tuning range to the other. This performance did not jibe with the Crosley claims published at the time the Pup was being promoted in 1925. They stated that the Pup was able to "tune out" strong local stations in favor of distant weak ones (in other words, it had good selectivity) and was able to receive stations at a distance of 1,500+ miles(good sensitivity).

Clearly some service work was needed. When I could locate no printed schematic for the Pup I drew one myself. Pretty simple regenerative circuit, I thought. But as John Haught (who drafted the schematic for me) reminded me, sometimes the simplest things are the most difficult to fix or understand. He was so right.

In the past few weeks I have traced the entire Pup circuit with an ohmmeter, checked antenna and ground, swapped tubes, measured capacitors with digital meters, twiddled with this, fiddled with that, and bugged everyone I could think of who might have further suggestions.

In short, I have spent many hours trying to improve the operation of my Pup, all to no avail. I don't want to believe that the original Pup literature radically mis-represented its performance ability. That would certainly would have put Crosley's reputation at considerable risk. I hope some reader with more Pup experience than I have will be able to assure me that either my Pup is operating okay and Crosley's literature was greatly puffed, or that further work on my distempered Pup is in order.

Startling! Revolutionary!
Crosley owns and operates WLW, first remote control super-power broadcasting station.
Crosley is the world's largest builder of radio sets and has built up a tremendous volume by offering the highest quality receiving sets at the lowest prices. More than a million satisfied users is the strongest testimonial of Crosley quality, simplicity, durability and value.
The CROSLEY Pup
It's a Sky Terrier
A Genuine Armstrong Regenerative double circuit receiver

Detail from 1925 ad for the Crosley Pup. Note the "Sky Terrier" Pup logo.

Note on Polarity of Pup Coils

A healthy Pup should break into oscillation when its tickler coil has been adjusted beyond a certain critical setting. If a Pup won't regenerate, one of the problems may be that the tickler coil leads have been reversed. The "outer" lead of the coil (originally terminated with a closed lug) must be connected to the phones terminal. The inner lead (with an open lug) connects to pin two of the tube socket.

On the three-lead stationary coil, the outer lead connects to the "book" capacitor and the inner lead connects to the aerial terminal. The "middle" lead connects to ground.

Bibliography

The literature on Crosley's Pup is either

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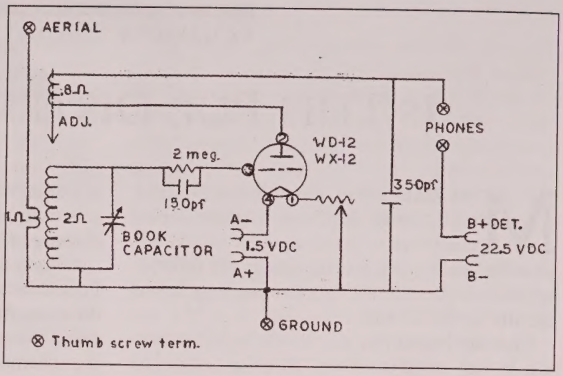
scant or elusive, so even mere mentions have been included here. Perhaps a "toy radio" or "child's radio" was not thought worth writing about in the mid 20s. The Dave Crocker and Richard Arnold article referenced below is the most substantial of the lot I've found, and it's just a page and a half.

There must be more out there. If you are aware of any articles not shown here please let me know so they can be included in a future, more robust list. Of course, there may soon be more information about the Pup on the Internet than there is in traditional printed form.



Schematic of author's Crosley Pup (see text). Drafting by John Haught.

Like most pups, this one was cute. So many of the publications listed contain photos or drawings of Powel Crosley's little Pup or "Sky Terrier."

Arnold, Richard. "Crosley Models 50 & 50A," *Antique Radio Classified*, Vol. 5, no. 5, May, 1988, p. 4. (Includes schematic similar to that of the Pup).

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Okolowicz, John. *Radio/TV Finder*. Antique Electronic Supply, 1991, p. 20.

Patterson, D. "Crosley Manufactures Under ACE Trade Name," *Radio Age*, December 1980, p.4.

Radio Age, Vol. 2, no. 1, January 1976, pp. 1-3. (Reprints of contemporary articles and ad from *Crosley Broadcaster* and *Radio World*).

Radio Magazine, September 1925, p. ? (Advertisement announcing $1000 Pup DX contest).

Stinger, Charles. "The Eminent Years of Powel Crosley Jr., His Transmitters, Receivers, Products, and Broadcast Station WLW, 1921-1940," *AWA Review*, Vol. 16, 2003, pp. 7-95. (See especially pp. 31-2.)

"Which Radio Set Is Ideal for You?" *Scientific American*, Vol. 133, October 1925, p. 253.

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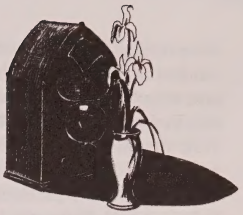
RECENT RADIO, TV AND ENTERTAINER OBITUARIES



COMPILED BY **CHARLES S. GRIFFEN W1GYR**
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Note: When known, the date of death is indicated in parenthesis.

ALBERT ABRAMSON, 81, (12-24-03) television engineer and historian. Abramson joined CBS in 1952 and was employed as television cameraman, video tape editor, sound man and video engineer at their Television City studios in Los Angeles. He retired from CBS in 1987 and performed consulting work for such organizations as RCA, Ampex, UCLA and HBO while continuing his research and writing. Abramson has written dozens of articles including two for *The OTB* (29-3-16 + 29-4-24) and the following books: *Electronic Motion Pictures: A History of the Television Camera* (1955), *The History of Television 1880 to 1941* (1987), *Zworykin: Pioneer of Television* (1995) and *The History of Television* 1942 to 2000 (2003). In 1996 Abramson received The Taylor Award from the AWA for his work in preserving television history. Thanks to Christopher H. Sterling for providing much of the biographical information.

CHARLES L. BROWN, 82, (11-12-03) telephone executive. Brown, who was Chairman of American Telephone and Telegraph Company, had to make the decision about the breakup of the firm. On January 1, 1984 the world's largest corporation was divided into the seven "Baby Bells" in order to settle the government's long-running antitrust suit against it. Brown described the decision a "wrenchingly difficult" one and after the breakup said "I think the nation in the long run will be sorry it happened." He began his career with AT&T in 1946, was named Vice President and General Manager of Illinois Bell in 1963, and in 1969 was elected Chief Executive. Brown became Executive Vice President of AT&T in 1974, Vice Chairman and Chief Financial Officer in 1976, President in 1977 and Chairman and Chief Executive in 1979. He retired in 1986.

ELIZABETH PFOHL CAMPBELL, 101, (1-9-04) educational television pioneer. Campbell was the founder of WETA(TV), the public television station serving greater Washington, DC. She was President of what became the Greater Washington Educational Telecommunications Association, the operating body of the station, from 1957 to 1971. The station's programming has grown from one elementary school science offering to the third-largest contributor of original shows to the Public Broadcasting System. Some of these include *The News Hour With Jim Lehrer, Washington Week in Review* and *The Kennedy Center Presents*. Newton N. Minow, former Chairman of the FCC, credits her with convincing Congress to pass legislation that created public television. Campbell, a career educator, felt television "could bring boundless information into classrooms and homes." In 1996 she received the Corporation for Public Broadcasting's Ralph Lowell Award for outstanding individual contributions to public television.

ART CARNEY, 85, (11-9-03) comic actor. Carney is best remembered for his role as Ed Norton in the television series *The Honeymooners* (CBS 1955-1956, 1971) starring Jackie Gleason and Audrey Meadows. He won five of his seven Emmy Awards for performances on that show. Some of his other TV credits include *The Morey Amsterdam Show* (CBS 1948-1949, Dumont 1949-1950), *Cavalcade of Stars* (Dumont 1950-1952), *The Jackie Gleason Show* (CBS 1952-1957, 1966-1970), *Kraft Television Theatre* (NBC), *Playhouse 90* (CBS) and *Studio One* (CBS). Carney began his career doing impersonations and singing with the Horace Heidt Orchestra. After leaving Heidt he performed in nightclubs and vaudeville before getting bit parts on the radio programs that required dialects (*Report to the Nation, Man Behind the Gun, Gang Busters),* daytime serials and comedy shows. Carney appeared on Broadway in the role of *Felix Unger* in The Odd Couple (1965) and in a number of films including *Pot O' Gold* (1941) starring James Stewart and Paulette Goddard, *Harry & Tonto* (1974), and *The Last Hero* (1993). He won an Oscar for his performance in *Harry & Tonto*.

ROBERT YORK CHAPMAN, W1QV, 96, (11-21-03) acoustical engineer. Chapman was the Director of the Acoustical Research and Development Division at the U.S. Navy Submarine Base in Groton, CT, where he led a program to

develop silencing mechanisms for ships. He also worked as the Navy's Chief Technical Consultant to submarine and destroyer training activities in the field of acoustics. Chapman was the New England Division Director for the American Radio Relay League (ARRL) from 1965 until 1975, when the Board of Directors elected him an ARRL Honorary Vice President. He was also President Emeritus of the ARRL Foundation, which he helped found in 1973. Chapman became a member of the ARRL in 1923 and was first licensed as 1QV in 1924.

JEANNE CRAIN, 78, (12-14-03) actress. Crain made her mark in the role of Elia Kazan, a black girl passing for white, in the movie *Pinky* (1949). A daring film for that time, the production earned her an Oscar nomination for best actress in 1949. Crain appeared in 64 films, playing opposite leading men like Frank Sinatra, Kirk Douglas and William Holden. A sampling of her film credits includes *The Gang's All Here* (1943), *Home in Indiana* (1944), *State Fair* (1945), *Margie* (1946) *You Were Meant for Me* (1948), *Vicki* (1953), *The Tattered Dress* (1957), *Madison Avenue* (1962), *Hot Rods to Hell* (1967) and *Skyjacked* (1972). Crain appeared on many television programs including *Star Stage* (NBC circa. 1955), *Ford Theatre* (NBC 1956), *Goodyear TV Playhouse* (NBC 1959), *General Electric Theater* (CBS 1962), *Burke's Law* (ABC 1964-1965) and the TV film *Meet Me in St. Louis* (1959).

DON DURGIN, 79, (12-26-03) television executive. Durgin was President of NBC Television from 1965 until 1973 when he was named Executive Vice President of the network. During his tenure he expanded NBC's production of original dramas, news and cultural specials and variety shows featuring Bob Hope, Frank Sinatra, Julie Andrews and Bill Cosby. Durgin headed the Radio Division of the American Broadcasting Company from 1951 to 1957. He joined NBC in 1957 and remained there until 1975 when he became President of McCaffrey & McCall, an advertising agency. In 1977 he joined Dun & Bradstreet as an Executive Vice President overseeing the firm's broadcast operations and its book and magazine divisions. He was named Vice Chairman of *Newsweek Magazine* in 1989 and remained there until retirement in 2001.

DR. JAMES M. EARLY, 81, (1-12-04) transistor pioneer. Early, an electrical engineer and inventor, is credited with much of the design theory of bipolar transistors developed at the Bell Laboratories in New Jersey. He joined their staff in 1951 and worked for Nobel Prize winner Dr. William Shockley. Early created the oscillator transistor for the first U.S. satellite, led the development of solar cells and transistors for the Telstar I satellite and took part in the original integrated circuit work. He was a Laboratory Director for the Bell Laboratories in Murray Hill, NJ from 1962 to 1964 and in Allentown, PA from 1964 to 1969. In 1969 he became Vice President of Research and Development at Fairchild Semiconductor in Palo Alto and remained there until retirement in 1986. He held 14 patents.

JOHN A. GAMBLING, 73, (1-8-04) radio personality. Gambling was the second of three generations to host *Rambling With Gambling* or its predecessor on WOR(AM) in New York City, a program that ran for a period of over 75 years. The morning news-and-talk show was first hosted by his father, John B., from 1925 until retirement in 1959. John A. took over the program from 1959 until 1990 when he was succeeded by his own son, John R., who remained with the show until it was canceled in 2000. John B. joined the staff of WOR as an engineer in March 1925 and within a few months was asked to fill in for a performer who failed to appear for his program. Gambling was so well received that the station gave him his own program, called *Gambling's Musical Clock*. It became *Rambling With Gambling* in 1942 and at its peak of popularity was heard by one million people from Maine to Virginia and west into the central states.

H. MARIN "MARTY" HAAG, JR., 69, (1-10-04) television executive. Haag was Senior Vice President/News of Belo Corporation's Television Group from 1989 until retirement in 2000. He joined Belo in 1973 as Executive News Director of WFAA(TV) in Dallas/Ft. Worth, where he was responsible for all phases of the station's news operations for sixteen years. Earlier he held positions as National Assignment Editor of NBC in New York City, Executive News Director of WKYC(TV) in Cleveland, Executive News Director of KTTV in Los Angeles and Assistant News Director of WCBS(TV) in New York City. Haag received many honors, including a special George Foster Peabody Award in 2001 for his longstanding contributions to journalism and the broadcast industry. He began his career while in college as a radio newsman with KBIA in Columbia, MO.

EARL HINDMAN, 61, (12-29-03) actor. Hindman was best known as "Wilson," the character in *Home Improvement* (ABC 1991-1999 and later syndicated) who gave advice to his neighbor over the fence without exposing his full

face. Prior to joining the show he played the role of Detective Lt. Bob Reid on *Ryan's Hope* (ABC 1973-1989). Hindman had many supporting roles in TV movies and miniseries and performed in a number of Broadway and regional stage productions. These included *Henry V* at the New York Shakespeare Festival, *Dark of the Moon* (1970), *The Basic Training of Pavlo Hummel* (1971) and *The Love Suicide at Schofield Barracks* (1972). Additionally, he acted in many films including *Two Into Three Won't Go* (1969), *The Parallax View* (1974), *Greased Lightning* (1977), *Murder in Caweta County* (1983), *The Ballad of the Sad Café* (1991) and *Final* (2001). Hindman completed work on *Beautiful Swimmer*, a short feature film for television, last June.

MARVIN HOBBS, 92, (1-9-04) radio engineer. Hobbs was Chief Engineer of the E.H. Scott Laboratories from 1939 to 1947. There he worked on the basic FM circuit used in Scott's pre-war FM sets, designed their first AM-FM combination receiver, the Laureate, and later designed and built the "classic" Model 800B AM-FM receiver. Prior to joining Scott, Hobbs was a receiver design engineer for Zenith Radio Corp., Delco Radio Division of General Motors and E.K. Cole, Ltd. in England. During WWII he served with the Radio and Radar Division of the War Production Board. Hobbs returned to Scott in 1945 and remained there until 1947 when he joined RCA to head their Berkshire development project. He was Chief, Electronics Division, Munitions Board, at the Pentagon from 1950 to 1952 and then returned to work in industry in a number of executive and director positions with a variety of firms. Hobbs worked for the Bell Telephone Laboratories from 1979 until his retirement in 1982. He wrote a number of radio and electronics books including two editions of *E.H. Scott, the Dean of DX*. Thanks to Kent King for providing much of the biographical information.

REGINALD HAROLD JONES, 86, (12-30-03) executive. Jones was Chairman and Chief Executive Officer of the General Electric Company from 1973 to 1981. He guided GE through managerial changes, emphasized new materials like plastics and expanded their business in foreign markets. During Jones' tenure the firm's revenues grew from $10 billion to $22 billion and earnings rose to $1.4 billion from $572 million. The British-born Jones began his career at GE in Schenectady, New York in 1939. There he entered the company's management training program and became a traveling auditor, visiting plant locations around the country. Jones later managed parts of GE's diversified operations—air conditioning, utilities, construction and distribution. In 1961 he became a Vice President of the parent company and in 1968 became its Chief Financial Officer. He became Senior Vice President in 1970 and President two years later.

EUGENE KLEINER, 80, (11-20-03) semiconductor industry pioneer and venture capitalist. Kleiner was the founder of Fairchild Semiconductor which launched a new industry and made the Silicon Valley a world center of technology. He and seven scientists left Nobel Prize winner Dr. William Shockley to develop a way to manufacture multiple transistors on a single silicon wafer. This breakthrough enabled them to raise $1.5 million from Fairchild Camera and Instrument Corporation and start Fairchild Semiconductor in 1957. In 1972 Kleiner and Tom Perkins formed a venture capital firm, Kliener, Perkins, Caulfield and Byers, which has invested in over 300 companies. Some of their investments included Sun Microsystems, Tandem Computers, Compaq Computers and Amazon.com.

LAURENCE A. TISCH, 80, (11-15-03) executive. Tisch, a self-made billionaire, took control of CBS Inc. in 1986 to prevent it from being acquired in a hostile takeover. His $750 million investment bought him a 24.9 percent interest in CBS and an invitation to join its Board of Directors. Tisch was later named Acting Chairman and Chief Executive, but indicated a desire to be replaced by a broadcast executive. Instead, Tisch remained the head of the firm until 1995, when Westinghouse Electric Corporation purchased CBS for $5.4 billion. During his management major divisions were sold, the CBS News Division's staff and budget were severely cut, station affiliates defected, ratings dropped and there was criticism that the "Tiffany Network" had lost its way. The price of CBS's stock, however, did appreciate in value during this period. Tisch and his brother, Preston Robert, developed and controlled the Loews Corporation, a financial firm with 2002 revenue of over $17.5 billion and assets of more than $70 billion.

LES TREMAYNE, 90, (12-19-03) actor. Tremayne was one of the best- known radio actors during the 1930s and 1940s. By his own count he estimated he had worked on more than 30,000 broadcasts and during the 1930s did as many as 45 programs a week. One poll during the 1940s cited him as one of the three most famous voices in America. The other two were President Franklin D. Roosevelt and Bing Crosby. Tremayne is perhaps best remembered as the debonair leading man of the *First Nighter* program (CBS, Mutual or NBC between 1936-

1943). He and his leading lady, Barbara Luddy, performed short dramas at the "Little Theater Off Times Square" where all the elements of a first night opening were present. Some of his other radio credits include *The Romance of Helen Trent* (CBS early 1930s), *The Jackie Gleason-Les Tremayne Show* (NBC 1944), *The Falcon* (Mutual late 1940s), *The Adventures of the Thin Man* (CBS 1948-1949) and *The Bob Crosby Show* (CBS or NBC between 1943-1950). Tremayne guest starred on many TV series, including *Perry Mason, The Rifleman, Wagon Train, Rawhide, The Andy Griffith Show, Mister Ed* and *The Virginian* and was a cast member of *One Man's Family* (NBC 1950), *The Adventures of Ellery Queen* (NBC 1958-1959), *Shazam!* (1974) and *General Hospital* (ABC late 1980s). Tremayne appeared in 40 films including *War of the Worlds* (1953), *Forbidden Planet* (1956), *North by Northwest* (1959) and *The Fortune Cookie* (1966). He was inducted into the Radio Hall of Fame in 1995.

DR. OSWALD G. "MIKE" VILLARD, Jr., W6QYT, 87, (1-7-04) electronics engineer. This pioneer benefited the amateur-radio community with numerous important technical developments. Born in 1916, he was first licensed in 1930 as W1DMV. Graduating from Yale University, he moved to Stanford to work toward an engineering degree. With studies interrupted by WW II, he went to work at the Radio Research Laboratory at Harvard. RRL was the "anti-radar" lab, a sort of counterpoint to the radar developers at the Radiation Laboratory at MIT. Villard worked on countermeasures like the use of "chaff" foil strips to blank out the displays on hostile ground radars and the "Carpet" airborne jammer. Despite this diversion, he got his Stanford degree in 1943. Returning West in 1946, he became an assistant professor and obtained a Ph.D. degree in 1949. He served on the Stanford faculty until about 1970, directing the Radio-Science Laboratory; then moved to the think-tank SRI International. His call sign in California was W6QYT.

Dr. Villard's greatest impact on amateur radio was showing the feasibility and benefits of SSB-SC (single-sideband-suppressed carrier) transmission over conventional AM. This he did via tests at W6YX, the radio club station on campus. The first contacts took place in 1947, on 20 and 75 meters. *QST* soon gave strong editorial support, running a series of articles by Villard and others. SSB was no new invention. It had been in AT&T commercial use on wire lines since 1917 and in transatlantic radio service since 1927. There had been a few articles in the amateur magazines in the '30s and limited experimentation. Villard's work rekindled postwar interest in this modulation technique. As a result, amateur use became widespread, while military and commercial applications universally went to SSB. It would be too much to declare Villard "the Armstrong of SSB," but he certainly left his mark.

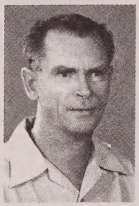
Villard used W6YX for other early demonstrations. His Ph.D. thesis was on scatter of radio signals from meteor trails, beginning with tests from the ham station. W6YX also figured in a series of 1952 tests of ionospheric backscatter, a radar-like method of detecting band openings by obtaining reflections from the earth at the distant edge of the skip zone. Of great amateur interest at the time, he designed the "Select-O-Ject," a versatile audio filter that would clear out heterodyne interference or emphasize a desired CW signal.

Villard enjoyed a career of professional research: detailed studies of meteor-echo phenomena, over-the-horizon radar research including detection of missile launches by backscatter, and ways to cancel radar reflections from stealth aircraft. He wrote numerous times in *QST* on the matter of long-delayed radio echoes. Finally, for the Voice of America he designed a simple and inconspicuous jamming-reduction loop antenna for construction by radio listeners overseas. It could receive a sky-wave (random-polarized) signal while ignoring nearby ground-wave (vertically polarized) signals. Dr. Villard was a Fellow of the American Academy of Arts and Sciences and of the IEEE. He was the holder of half a dozen major professional awards arising largely from his ionosphere research. A special thanks to Ludwell Sibley, KB2EVN, for providing this biography of Dr. Villard.

Information for this column was obtained from *The AWA Review*, Vol. 11, 1998, *The Big Bands* (4th ed.),*The Complete Directory to Prime Network TV Shows* 1946-present (4th ed.), *The Encyclopedia of Jazz* (1st ed.), *Hartford Courant, The Old Timer's Bulletin, On the Air: The Encyclopedia of Old-Time Radio, QST*, www.2.arrl.org, www.belo.com, www.broadcastingcable.com, www.latimes.com, www.mst3kinfo.com,www.nytimes.com, www.pf.inc.com, www.radiodaze.com, www.stanford.edu, www.us.imdb.com and www.washingtonpost.com.

Thanks to Marc F. Ellis, N9EWJ, Carroll E. Garrison, K4KSU, Kent King, Ludwell Sibley, KB2EVN, Christopher H. Sterling, Paul F. Thekan, N6FEG, and Dr. A. David Wunsch for additional source material.

CHRISTIAN R. FANDT



SILENT BRASS

A brief biography of Earl W. Korf, K2IC

Earl Korf, K2IC, was well known to AWA members and in amateur radio and aviation circles. He passed away on 23 November, 2003 at his home in Lincroft, New Jersey after a lengthy battle with cancer. He was 99 years young. We briefly reported his death in the February *OTB* "Silent Keys" column. There had been several brief articles written on Earl and this one is based upon three which were kindly forwarded to us by his son Greg and a friend, AWA member Maynard Lonis, W2MXE.

In his nearly 100 years, Earl had personally witnessed the growth of wireless communication almost from its beginning, just after the dawn of the 20th Century, through to the development of the latest 21st Century cellular telephone technology. He was born in 1904, in Oklahoma Territory, just a short while after Marconi's early wireless demonstrations in 1903.

Earl's father had been a railroad telegrapher, which inspired him in 1919, at age 15, to study for and receive his amateur radio license. His family then resided in Napa, California and his call was 6WX.

His professional brass-pounding career began a few years later, when he operated Western Union stations in the San Francisco Bay area. He worked for WU until March, 1924 when he received his first commercial radiotelegraph license. Upon receipt of that license he joined the San Francisco RCA Marine station, KPH.

Soon after, Earl became a seafarer and shipped out on several vessels operating along the west coast and Alaska.[1] He went ashore in 1928, and for the next 2½ years worked as a radio operator at station KHT, Naknek, Alaska.

In 1930, he joined Trans World Airlines (TWA) and spent the next 34 years with that company—the first twelve as a ground station radio operator at stations from coast to coast. In 1942, not long after our country entered World War II, TWA came under control of the US Army Air Transport Command. Still a civilian, Earl became a flight radio operator. In 1943 he became a flight navigator and flew many interesting transport missions. Among his most notable were delivering General Jimmy Doolittle to Washington after his raid on Tokyo; transporting Generals Dwight Eisenhower and Mark Clark to London just after Eisenhower had been named Supreme Commander of Allied Forces; ferrying President Roosevelt to the Casablanca Conference, where he met with Churchill and Stalin.

Earl also navigated on a couple of flights over the "Hump" in the Himalayas, taking Madame Chiang Kai-Shek to the USA and back to China. One of those flights was Earl's most harrowing. He was taking Madame Chiang Kai-Shek back to China on a DC-4 with a cargo of washing machines, refrigerators, radios and other gifts showered upon her during her visit. With the plane at maximum gross weight, the captain decided to fly the "Hump" from Gaya, India to Chungking at night—which was prohibited. He had also forgotten that all navigational aids would be turned off.

They flew for hours through thunderstorms, turbulence and icing conditions until it was decided they'd better turn back and try to make the US Army Air Corps base at Chabua, India before the fuel ran out. As they were flying heavy, 17,000 feet was their altitude limit and they had to weave among 22,000 foot mountain peaks while they made their way back. Although directed to maintain complete radio silence, the Captain radioed a request for a beacon to be turned on as they neared what they thought might be Chabua. The ground crew refused the request, thinking the aircraft might be Japanese. Only after Earl had several crew members speak to the ground using American slang was the beacon turned on. The DC-4 landed at Chabua with less than 20 minutes of fuel remaining. It was a night to remember but not repeat as Earl completed his wartime flying.

After the war, Earl eventually became Supervisor of Navigators at TWA. He left the airline in 1964 at the mandatory retirement age of 60. Subsequent years were spent doing free-lance navigation for the CIA and various airlines. In 1967 he signed on with Seaboard World Airlines as a navigator, flying cargo-transport aircraft to Viet Nam. Earl's aviation career culminated in 1970 at age 66 after more than 15,000 flight hours, over 1,400,000 air

Above: Earl W. Korf as a young man.

(continued on page 66)

AUTHOR'S ADDRESS: 31 HOUSTON AVE., JAMESTOWN, NY 14701-2627

CLASSIFIED ADS

Old-time ads are free to members collecting and restoring equipment for personal use. Please observe the following: (1) one ad per issue per member; (2) include as SASE if acknowledgement is desired; (3) material must be more than 25 years old and related to electronic communications; (4) give your full name, address and zip code; (5) repeats require another notice (we are not organized to repeat automatically); (6) the AWA is not responsible for any transaction; (7) we retain the right to reduce an ad's size if over seven lines; (8) AWA does not accept commercial advertising in this column; and (9) closing date is six weeks prior to first day of month of issue. Ads received after that time will be held for the following issue. Mail all ads to: **RICHARD RANSLEY, P.O. BOX 41, SODUS, NY 14551**.

IMPORTANT!

OTB classified ads are now available for browsing in the *"OTB On Line Edition"* on our internet web site (www.antiquewireless.org). This practice will give members dramatically increased exposure for their ads.

SELL/TRADE—BC/SW TUBE RADIOS

Sparton M770 floor model radio. Has some cabinet damage, $50.; National SW-54 receiver cabinet, fair condition, $20.; May trade above for Hallicrafters stuff. Al Brokaw, 4262 Co. Rd. 23, Cardington, OH 43315 (419) 046-1673 E-mail: ajsmscrb@bright.net

Vintage car radio, Pontiac 1947, for 6 volt system, 8 tubes, 5 preselect stations, very good condition, $50. Michael Durand, 21 LeGrande Avenue, Tarrytown, NY 10591 (914) 631-0493 For pictures E-mail: radioman10591@yahoo.com

Crosley Model 03CP console radio/phonograph, 1941, wood (good shape), BC, SW, AC, 10 tubes, all good, schematic, new capacitors, original knobs brittle; pushbuttons all good, radio plays, but function selection switch causes some static, turntable works but won't play a record. $125., must pick up. Ron Ebner, 128 Taft Street, Wind Gap, PA 18091 E-mail: roncar@epix. net

Have the following tube radios: 1950s Telefunken, $80.; 1940s Tesla, $80.; 1950s Murphy, $70. Argrios Adamidis, Panoramatos 38, Panorama, Thessaloniki, Greece 55236 E-mail: aadam@acc.teithe.gr

SELL/TRADE—GENERAL

Edison cylinder phonograph with outside horn, $450.; Federal #200 drop-in radio chassis, like new. Walt Wrabek, 10750 159 Ave., Minahga, MN 56464

WWI "Flame-proof" key, $65.; Fire box key, brass, tiny, unique, $125.; other misc. telegraph keys, $15-$50.; assorted relays and sounders, $25.-$50.; Daven 3-tube amp. w/3 tubes, $75.; Stromberg Carlson mike on telephone style stand, $125.; meters made for Radiola 20 and 25 receivers, $30.; "Philco Radio Service" electric dealer sign, $85.; W.E. 7A amp. w/3 type 216A "tennis ball" tubes, $575.; Amberola phonograph, in oak box, $375. Dave Crocker, 35 Santuit Pond Rd., #4B, Mashpee, MA 02649 (508) 477-1578 before 9 P.M. E-mail: radio-1@comcast.net

Accepting offers on the following items: Western Electric 7A amp., Amrad Double Decker (tuner/detector/amp), Clapp Eastham HR & HZ, Westinghouse RADA, Kennedy V, Grebe Syncrophase and a Navy Type Loose Coupler. Dick Schamberger, 167 Radley Dr., Painesville, OH 44077 E-mail: tellie@nccw.net

1918 Western Electric Company 394 type condenser microphone in the WE enclosure. Literature is available on the microphone. Les Rayner, 5512 N. 71st Place, Scottsdale, AZ 85253 (480) 947-1375

Radio tubes, used and tested OK, at reasonable prices. Galena crystal radios and/or parts to build your own. Old radio parts available also. Len Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150 E-mail: radiolen@att.net

Motorola converter Strata-tuner Model TC 707A. Appears complete, not tested, $10. plus 10 lb.. S&H. John Uscinowski, 95 Vly Summit Road, Greenwich, NY 12834

Must sell everything. Many AC-DC radios with Civil Defense on dials, ham transmitter and receiver coils, variable capacitors, plug-ins, 100

drawers of resistors, 1500 electronic books, 200 equipment manuals, 300 catalogs, 25 microphones, 8 power supplies and complete 20-instrument Radio-TV Service Shop. Francis Yonker, W2IBH, 1229 N. Inverary Place, State College, PA 16801 (814) 867-1400 E-mail: yonker1229@adelphia.net

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Philco 116RX Mystery Remote Control as seen in November, 2003 OTB page 51, "Forerunner of the TV Wireless Remote," $75. Mike Grimes, K5MLG, 3805 Appomattox Circle, Plano, TX 75023 (972) 867-6373

Stewart Warner radio chassis, Model 07-51-14, $25.; pick-up arm for wind-up phonograph, $20.; Heathkit tube checker, Model TC1P, with manuals, $45.; Sencore tube leakage checker, Model LC3, $15.; (2) Sencore Vibrator Checkers, for both 3 and 4 pin, both $7.; Pamona Vibrator Checker, 4 pin, $5.; (2) Sencore Filament Checkers, $5. each,; Taybern Equipment Co. Mystery Phone, $5. All plus shipping. Want a Philco chassis Model 37-630 and speaker, clean and complete with no rust. Robert Rossi, 10936 Melbourne St., Allen Park, MI 48101

Have too much stuff! Send a SASE with two stamps or E-mail for list of tubes, parts and books. Wayne LeTourneau, P.O. Box 62, Wannaska, MN 56761 E-mail: letourneau@wiktel.com

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Heathkit Q Multiplier, $10.; pair of Lafayette Walkie-Talkies, $20.; Eico 526A Multimeter, $10.; Hammond 600 ohm audio output transformer, unused, $20.; Precision E400 Signal Generator, $25.; Heathkit Grid Dip Meter, $10. Call for additional information. Robert Martin, 111 Bancroft Drive, Rochester, NY 14616 (585) 663-4182

Atwater Kent Type E speaker, with gold emblem,; Technical manual for National NCX 1000 transmitter, $35.; Heathkit Stereo Amplifier, Model AA-32,; Bakelite panel, 2 ft. by 5 ft. and one inch thick.; McIntosh Model 1900 stereo receiver; Hallicrafters Sky Champion; novelty Guild morninglory horn/turntable/radio/victrola reproduction. Paul Recupero, 265 Union St., Portsmouth, RI 02871-2264

SELL/TRADE—LITERATURE

1928-1943 European radio schematics, more than 1400 diagrams, $90.; Telefunken 1932-1939 radio set-up book, $12.; old 1908 industry alphabetical catalog, 1770+ pages with lots of lithographs (German), $50.; old radio tube books, catalogs, brochures (Radio Tube Vademecum, Sylvania, GE, Purotron, Tunsgram, Valvo, Loewe, Geloso, Stancor, Telefunken); French radio magazine "Toute la Radio", 1936 volume 484 pages, $30.; Argyrios Adamidis, Panoramatos 38, Panorama, Thessakoniki, Greece 55236 E-mail: aadam@acc.teithe.gr

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Sams TSM (Transistor Service Manual) (1-132), $300. Jerry Talbott, 4403 Birdhaven Loop, Newberg, OR 97132 (503) 538-4041 E-mail: vinradio@easystreet.com

SELL/TRADE—PARTS

Transmitter meter panel. Rack-mountable includes five meters for One KW Xmtr. 12" by 36" steel. Contact for layout, description, $75. plus shipping. Charles Graham, 4 Fieldwood Drive, Bedford Hills, NY 10507 (914) 666-4523

High-voltage film, electrolytic and mica capacitors for tube radios. Now available are 500 volt dipped silver mica capacitors in all sizes from 5 pF thru 5000 pF (including pre-WWII mmfd sizes). For price list and product info, please contact Dave Cantelon, 42 Clematis Rd., North York, Ontario, Canada, M2J 4X2 (416) 502-9128 E-mail: justradios@yahoo.com or visit our Website www.justradios.com

SELL/TRADE—TRANSISTOR/CRYSTAL SETS

Old Soviet multiband transistor radio, $50.; French Telemonde transistor radio, $50.; various shirt pocket transistor radios, $30. each. Argyrios Adamidis, Panoröamatos 38, Panorama, Thessaloniki, Greece 55236 E-mail: aadam@acc.teithe.gr

SELL/TRADE—TUBES & TRANSISTORS

Two Sylvania 1625 tubes, $10.; One GE GL8020, $20. No boxes for either.; CRT JAN 5FP7A, $10. Robert Rossi, 10936 Melbourne St., Allen Park, MI 48101

WANTED—COMMUNICATIONS GEAR

BC729 antenna tuner, as used on the early BC610 transmitter. LP-22 loop antenna for BC-470 DF receiver. Paul Thekan, 335 Rutherford Ave., Redwood City, CA 94061 (650) 367-1499 E-mail: Paul Thekan@cpii.com

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Heathkit SB-102, SB-220, SB-110, SB-500, SB-600, HP-23 (A), (B), (C) and HDP 21 or 21A. Also consider any Heathkit amateur gear. Stan Sepiol, AB2MA, 556 Benjamin Rd., Cayuta, NY 14824 (607) 739-3276

WANTED—GENERAL

National 7 inch TV set, Model TV-7M or TV-7W. Not working is fine. Top price paid. Thanks. Charles Harper, 2000 Jackstown Road, Paris, KY 40361 (859) 484-9393 E-mail: charper@kyk.net

Regenerative commercial type receivers such as Doerle or Super Clipper, 1936-8. Also want a 1936 Sky Buddy. Carl Davis, W9CR, 121 N. Scott, Westville, IL 61883

WANTED—LITERATURE

Need schematic for Mallory vibrator tester Model 12VT1D. It tests all the varieties of vibrators together with rectifier, under load. Len Aquilino, 7187 Lakeshore Rds., Cicero, NY 13039

Service notes on RCA Model R-80 receiver. Jack Hubbard, 13113 River Road, Milan, OH 44846

Books and articles about the development of magnetrons before 1940. Derk Rouwhorst, Noorderhagen 56, 7491 AS Delden, Holland fax 010 31 74 376 3500 E-mail: derkrouwhorst@hotmail.com

Remler catalog or literature from the early 1920s (copy OK). Dan Howard, 2940 SE 118th Ave., Portland, OR 97266-1602

WANTED—PARTS

National Type B vernier dial for my SW-3. Len Gardner, 458 Two Mile Creek Rd., Tonawanda, NY 14150, E-mail: radiolen@att.net

Band selector knob for Zenith Transoceanic Royal D7000. Robert Rossi, 10936 Melbourne St., Allen Park, MI 48101

Tuning head for 1939 Ford/Mercury Zenith radio, Model 6M390. Must be complete. Ed Schmidt, 9723 Carter Dr., Overland Park, KS 66212 (913) 888-9511

Metal box and lid for an Atwater Kent Model 40, in excellent to very good condition. Ronald Graves, 3120 N. 72 Way, Hollywood, FL 33024-2423

National Type DX variable condenser, any value. National aluminum dial reference pointer. Cardwell split-stator variable MR-260-BD. Trade or reckless purchase. Louis Vermond, VA3AWA, Box 543, St. Marys, Ontario N4X 1B3 Canada E-mail: Ldvermond@sprint.ca

Cabinet for Zenith 5R236 or junker chassis with good cabinet. Marc Ellis, 1914 Colfax St., Evanston, IL 60201; 847-869-5016; mfellis@rcn.com

WANTED—TUBES & TRANSISTORS

CW11, E465, E639, E821 and E880. Derk Rouwhorst, Noorderhagen 56, 7491 AS DeLden, Holland fax 010 31 74 376 3500 E-mail: derkrouwhorst@hotmail.com

SILENT BRASS, *continued from page 63*

miles and 815 ocean crossings.

An avid amateur mountain climber, Earl scaled the Matterhorn on his 50th birthday and climbed the highest points in 35 states. His son, Richard, also became an expert climber.

He was a life member of Veteran Wireless Operators Association (VWOA), Society of Wireless Pioneers and the Veterans of Foreign Wars, Middletown Post 2179. His other memberships were with the AWA, ARRL, Garden State Amateur Radio Association (GSARA), Old Timers Club (OOTC), QCWA, Old China Hands (memorial organization of those who flew the "Hump" and served in the China-Burma-India theatre in WWII), the Morse Telegraph Club (MTC), the OX 5 Aviation Pioneers, Retired Professional Navigators (RPN), and the International Association of Airline Hams (IAAH).

Among his many recognitions were the VWOA Fifty-Year Certificate, VWOA ARC/SPARK Certificate and the QCWA Seventy-five-Year Certificate. On May 17, 1997 he was awarded the Marconi Memorial Gold Medal from the Veteran Wireless Operators Association for serving as a Radio Officer on land, sea and air. His listing in the 1997 *VWOA Yearbook* article reported that he held First Class Radiotelegraph and US Coast Guard Merchant Marine Radio Officer licenses in addition to his FCC Amateur Extra ham ticket.

We are left to wonder how much more time his fellow hams would have enjoyed Earl's familiar fist over the air if he had not been taken by cancer. He was still pounding the brass only three weeks before his key was silenced. Earl is survived by his wife of 50 years, Suzanne; his sons Gregory of Lincroft, NJ and Richard of Los Angeles; a sister, Midred Steele of Fair Oaks; and several other relatives in California.

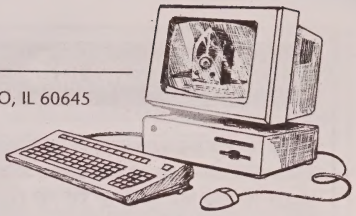
[1]Please visit John Dilk's website: http://www.eht.com/oldradio/arrl/2003-03/Korf/earl-korf.htm for a very interesting story of Korf's seafaring and radio operating days around Alaska and the West Coast.

REFERENCES

1. *The World Wireless Beacon*, June/July 1997, SWOP journal
2. *The World Wireless Beacon*, September/December, 2003, SWOP Journal (Both *Beacon* articles forwarded by his friend, AWA member Maynard Lonis, W2MXE)
3. VWOA 1997 *Yearbook*
4. Notes from Gregory Korf
5. Obituary from the *Asbury Park Press*, 11/25/03

On the Internet

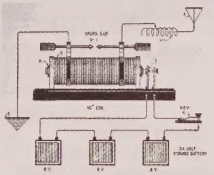
EDITED BY **CHUCK SCHWARK**, 7454 N. CAMPBELL AVE., CHICAGO, IL 60645
PLEASE INCLUDE SASE FOR REPLY. E-MAIL: caschwark@aol.com



Wireless Telegraphy on the Web

The wireless telegraph is not difficult to understand. The ordinary telegraph is like a very long cat. You pull the tail in New York and it meows in Los Angeles. The wireless is the same, only without the cat. —Albert Einstein

Here is a look back at the beginnings of wireless communications. As the land-based telegraph was maturing in the later half of the 19th century, the investigations into Herzian, or electromagnetic, waves by many experimenters were also coming into its own. The marriage of these two technologies spawned the earliest radio communications receivers and spark transmitters, the latter known for their dangerous operating methods.



There is a wealth of historical data on the web, both from North American sites and those in Europe, where much of the early apparatus was developed. Below is just a small sample of the websites offering a glimpse into the past.

Ah... I can smell the ozone...

John Jenkins' Spark Museum
http://www.sparkmuseum.com/SPKTRAN.HTM

This very nice website is a "virtual" radio and scientific instruments museum displaying John's collection over the past 35+ years. The section on Spark Transmitters is very interesting with historical data and many pictures.

Longwave Club of America
http://www.lwca.org

This organization is dedicated to long-wave communications and equipment. Early wireless telegraphy equipment was designed to operate in this part of the radio frequency spectrum.

Rod Beavon's Spark Transmitter
http://www.rod.beavon.clara.net/spark.htm

This site, located in the UK, has plans for making your own apparatus and some background information. *NOTE: Operating a spark transmitter is illegal. It interferes with any and all radio, television and public service and safety communications!*

The W1FJI Wireless Museum by Art Marshall
http://www.vistech.net/users/w1fji/museum.html

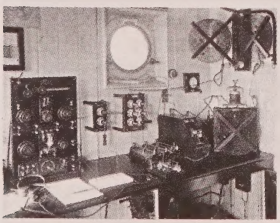
Great photos of early 20th-Century spark stations. Lots of historical information and pictures of related equipment. Many links to other early spark and wireless websites.

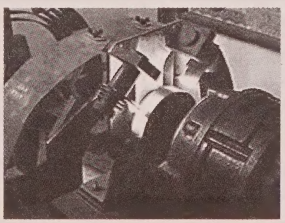
Wolverhampton Museum of Industry
http://www.localhistory.scit.wlv.ac.uk/Museum/Engineering/Electronics/history/earlytxrx.htm

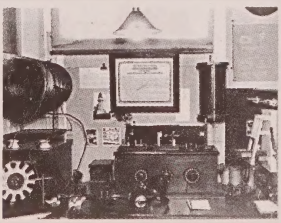
This UK museum covers all aspects of their local industrial, electrical and technical history. One of the many interesting sections of this site contains early wireless transmitters and receivers. The site has both pictures and schematics.

The AWA Electronic Communications Museum
http://www.antiquewireless.org/museum/museum.htm

Last but not least, we can't forget our very own Museum which has exhibits of early wireless receivers and transmitters. The Museum is home to the infamous AWA "Rock Crusher" spark transmitter.







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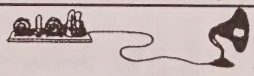
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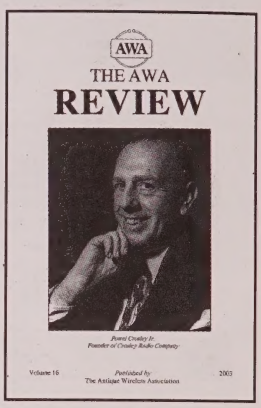

The lead article on Powel Crosley, Jr. and the Crosley Radio Company is by Charles J. Singer, a long-time employee. Crosley's many business endeavors are described, with particular emphasis on radio manufacturing and broadcasting. This particularly detailed paper includes many never-before-seen photographs.

The development of the portable spark transmitter-receiver "pack sets" made, for the U.S. Navy and the Army Signal Corps, is chronicled by the team of Russ Kleinman, Karen Blisard, Jim and Felicia Kreuzer and August Link. This article also includes many early photographs that have never been presented in print.

Charles Kirsten traces the development of the well-known and widely-used Rider's Manuals for radio repair. Few realize the complex stages of development that went into the creation of these books and the influence on them of major characters and personalities in the radio service field.

An unusual article by Barbara Havranek addresses an often-overlooked aspect of radio history: the speaker grill cloth. The author, an expert in the field of industrial design, discusses both the aesthetic and technical aspects typical cloths. A full-page color plate shows thirty-four of the designs discussed in the text.

This volume also includes a cumulative table of contents of all the *AWA Reviews* produced since publication began in 1986. *Price, $19.95 postpaid in U.S. and Canada; elsewhere,add $5.00.*

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Another out-of-print classic, *The Hallicrafters Story* by Max Dehenseler, HB9RS, is also back as a CD. Max De Henseler was a personal friend of Hallicrafters founder Bill Halligan, and his book provides unusual insights into Halligan's life and early struggles. This well-illustrated book has 245 pages, a nice index and several handy lists of models and features. The CD can be displayed on any PC with Acrobat Reader version 6.0 or higher.* Thanks so much to Max De Henseler for his thoughtful gift of publishing rights to the AWA Museum. Price is $14.95, postage paid in U.S. and Canada; elsewhere, add $5.00.

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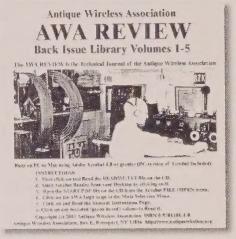

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Master index of *The OTB*, *The AWA Review*, and other AWA documents through March, 2000. Supplied on a 3.5-inch floppy disk in text format. Searchable with your word processor. Price, $9.00 postpaid in U.S. and Canada. NOTE: This index is included on the *AWA Review* CD ROM and both of the *OTB* CD ROMs.

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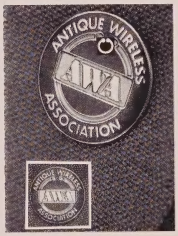

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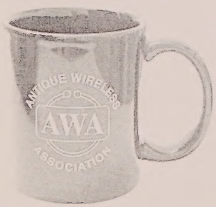

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